

# AVIATION WEEK

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PUBLICATION

May 21, 1956

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Plane for Army



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Nine Sargent controls units have been selected to provide Chance Vought's F4U-1 Corsair with thrust reversers, parking, feather flap systems. These units, designed fabricated to Vought specifications, provide a system for control for the safe, positive, efficient operation of the great fighter.

The experience of more than 56 years of design and manufacture of precision equipment systems has given Sargent Engineering Corporation the "know-how" to aid in solving the present and future problems of more control. Landing, airborne and engine, transmission, etc. using hundreds of different Sargent hydraulic, mechanical, pneumatic, electrical and electronic force control units on the various airframe planes, mechanical planes and motors.

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### AVIATION CALENDAR

- May 24-26—Vandeventer Commemorative and Historic Aviation 19th national convention, Boston, Mass.
- May 28-June 1—Eighty-Ninth Wright Memorial Ohio Meet sponsored by The Soaring Society of Dayton, Dayton
- June 2—Ninth Annual Maintenance & Operations Meeting, Boeing, Seattle, Wash.
- June 3—Ninth Annual Meeting, National Aeronautics Association, Hotel Statler, Boston
- June 3-5—Society of Automotive Engineers annual meeting, Quabbin Hotel, North Adams, Mass.
- June 4—Ninth Air, Protection, Aviation Safety Seminar, at the Statler Hotel, New York, N. Y.
- June 10-11—Society of the Plumber and Pipe Fitter National Plumber Exposition, New Orleans, New York, N. Y.
- June 12-13—Society of the Plumber and Pipe Fitter National Plumber Exposition, New Orleans, New York, N. Y.
- June 14—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 15—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 16—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 17—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 18—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 19—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 20—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 21—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 22—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 23—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 24—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 25—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 26—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 27—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 28—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 29—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.
- June 30—Ninth Annual Air Show, sponsored by the United States Army, at the National Airport, Washington, D. C.



airplane **CONVAIR F-102A**  
engine **F & W A J-57**  
ignition **G. L. A.**

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**How the country's largest  
exclusive producer of punches and dies  
changed complaints to contracts**

*...with Graph-Mo® steel*

**P**ORTER Precision Products, Cincinnati, Ohio, is the country's largest exclusive manufacturer of punches and dies—57,000 different sizes in stock. Formerly, Porter produced these products from water-hardening and other high carbon tool steels, but found that such steel presented distinct disadvantages. For example, they distorted on heat treating, were relatively expensive and difficult to machine, and did not meet customers' demands for longer life.

With a view to converting these problems, Porter sought more adapted Graph-Mo—one of four graphitic tool steels developed by the Timken Company—as a standard for the manufacture of punches and die bars. Because it contains fine graphite, Graph-Mo is easier to machine. And punches and dies made of Graph-Mo don't warp or

gall. From every aspect, Porter's adoption of Graph-Mo steel has proved extremely successful.

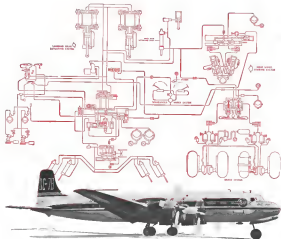
Graph-Mo performs ordinary tool made on an average of three to one. Millions of tiny particles of diamond-sized carbide—one of the most wear-resistant substances known—give Graph-Mo steel longer service life.

Graph-Mo may be the solution to your punch and die problems. For more information about all four graphitic steels developed by the Timken Company, and their uses in dies, punches, gages, and machine parts, write for the new Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Circle address "TIMKENCO".

TRADE AREA—EASTERN EXPERIENCE AND RESEARCH



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Versatile Enjay Butyl rubber may well have a place in your operation. It will pay you to investigate the many technical advantages it has over other types of rubber. Its price and ready availability are advantages, too. For full information, and for technical assistance in the uses of Enjay Butyl, contact the Enjay Company today.



Enjay Butyl is the most durable rubber with outstanding resistance to aging + stress + tear + slipping + cracking + ozone and corrosion + chemicals + paint + acid + alkali + sunlight + moisture.



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TACAN is the trustworthy electronic navigation system that accurately guides pilots through fog and foul weather every second of the flight. Two compact dials on the instrument panel automatically show the pilot his exact distance and direction from a fixed ground station with an accuracy never before attained. Result: greater safety in any weather, any place.

Born of TACAN's advantages over other systems include: three times greater accuracy, handles more surface traffic—allows planes to fly safely at closer intervals; permits starting landing approaches further out—substantially "takes up" all planes waiting to land; meets military requirements for ruggedness, compactness and mobility.

The same teamwork, experience and facilities at Hoffman Laboratories that put TACAN into full scale production are available for you to use—whatever the size or complexity of your electronic needs. Why not discuss your specific system engineering problem with a Hoffman Labs' representative now?

### TACAN TITLES YOUR PILOT'S DUTY



Range indicator indicator  
Lambert electronic indicator



Control Panel



Receiver  
Transmitter  
Receiver indicator  
Receiver indicator indicator  
Receiver indicator indicator

Range indicator indicator  
Lambert electronic indicator

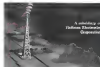
RECEIVER INDICATOR  
Lambert electronic indicator  
Lambert electronic indicator  
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CONTROL PANEL  
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## WEATHCO QUICK-DISCONNECT SELF-SEALING COUPLING



**PUSH ON...PULL OFF...! THERE IS NO PARTIALLY LOCKED POSITION**

### EASE OF INSTALLATION

The coupling is predrilled with standard fittings and built-in flange so that it is readily adaptable to your present and future designs.

### EASE OF OPERATION

Push the coupling on—pull the coupling off—it's so simple as that. No twisting or other gymnastics required.

### SAFETY

Coupling stays locked, even with repeated oscillations in excess of 35g applied in a direction most likely to cause unlatching. There is no partially locked position.

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Air induction negligible... meets standard AN and MS "O" rings... no special tools required. Oil loss and pressure drop less than specification rate.

For detailed information write for Bulletin AM-12.

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### SILICONE PRODUCT INFORMATION GENERAL ELECTRIC COMPANY

### SECTION 41-30 WATKINS, NEW YORK

Please send me, at no obligation, technical data on G-E silicone rubber including a newly revised "Lightning Selector" and up-to-date list of distributors.

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24 CIRCULAR 111, 74 CIRCULAR 111, 75 CIRCULAR 111, 76 CIRCULAR 111, 77 CIRCULAR 111, 78 CIRCULAR 111, 79 CIRCULAR 111, 80 CIRCULAR 111, 81 CIRCULAR 111, 82 CIRCULAR 111, 83 CIRCULAR 111, 84 CIRCULAR 111, 85 CIRCULAR 111, 86 CIRCULAR 111, 87 CIRCULAR 111, 88 CIRCULAR 111, 89 CIRCULAR 111, 90 CIRCULAR 111, 91 CIRCULAR 111, 92 CIRCULAR 111, 93 CIRCULAR 111, 94 CIRCULAR 111, 95 CIRCULAR 111, 96 CIRCULAR 111, 97 CIRCULAR 111, 98 CIRCULAR 111, 99 CIRCULAR 111, 100 CIRCULAR 111

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PRECISION  
FLOW MEASUREMENT**

**THROUGHOUT THE AIRCRAFT INDUSTRY,** bearingless Pottermeters are delivering accurate flow data during testing of aircraft, engines, rocket motors, and hydraulic systems.

**LINEARITY WITHIN 1/10%** over an exceptionally wide range, as well as long life in difficult service, is obtained through hydraulic positioning of the unique "floating piston". This patented design feature, found only in the Pottermeter, completely eliminates thrust friction and does away with inaccuracy and maintenance problems due to bearing wear.

**APPLICATIONS** include reciprocating, jet and rocket engine test cells and flight test work. Pottermeters are also in wide use in handling aircraft and rocket fuels, acids, liquefied gases and abrasive suspensions.

**WRITE** for bulletin S-1 giving a complete description and performance data.

**Potter** **POTTER AERONAUTICAL COMPANY**  
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**LIVABILITY WITHIN** 4-1/2' over an exceptionally wide range, as well as long life in difficult service, is obtained through hydraulic positioning of the unique "floating" potter. This patented design feature, found only in the Pottermaster, completely eliminates thrust friction and does away with noisiness and maintenance problems due to bearing wear.

**NOTE** See bulletin B-2 giving a complete description and performance data.

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The alphabet of lethality culminates in K&B — instantaneous destruction of target aircraft.

The Armament Division of Aerojet-General develop and manufacture air-to-air ordnance of outstanding accuracy, penetration ability, and destructive power.



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Floor space of the huge Hayes plant is equivalent to 27 standard football fields. The facility embraces 19 manufacturing bays — each 10 feet high, 100 feet wide and 750 feet long — all under roof. The total covered area is 1.25 million square feet. Total area, including supporting buildings, networked parking spaces, exceeds 3 million square feet.

Size plus modern equipment, plus capable engineering, plus skilled craftsmanship give Hayes a place in the forefront of America's aircraft modification industry.

### POSITIONS OPEN FOR ENGINEERS

With nearly 6,000 employees, Hayes is now seeking first-class industrial facility for modification and maintenance of aircraft — including large jet airplanes.

Opportunities open for experienced design, engineering, drafting and manufacturing personnel in the Aircraft Modification Department.

Point of view of Hayes 12 bays after renovation project is complete.



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THE ALL PURPOSE M&I HELPS GREATLY TO SOLVE THE MOBILITY PROBLEM . . . FOR ONE UNIT TAKES THE PLACE OF FOUR OR FIVE



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# B.F. Goodrich

## AVTRIM FLIGHT RUGS

Stepped on  
**83,335,200**  
times without  
losing face

Turn "anytime flight deck" as much as B. F. Goodrich plans. It is a single wool rug covered by one coat of Avtrim flight rug in 10 colors, 3 finishes. During a one year test recently completed over 83,335,200 footsteps pounded the Avtrim surface. Yet, when taken up, the face of the rug was still unscratched, its color bright as new.

Avtrim flight rug not previously known to navies and services. A spangly wool or anyone looking gives you a comfortable, cushiony step. Yet Avtrim carpets never curbing. Avtrim flight rug come in a variety of colors and finishes and any color to match your decorative scheme—all without the maintenance problems of expensive carpeting. B. F. Goodrich Avtrim comes in all grades, for use on ordinary areas—can be wiped clean with soap and water on the spot.

If you are designing a new plane or converting your fleet, you'll want all the benefits of Avtrim. Your BFG representative will be glad to show you samples. Representatives: Sales, B. F. Goodrich Tire and Equipment Company, a Division of The B. F. Goodrich Company, Akron, Ohio.

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## EDITORIAL

### Mid-Way in the Airpower Budget Battle

At the halfway mark in the battle over the Fiscal 1957 airpower budget, the Eisenhower Administration has seemed strongly to the public pooling of its military and civilian entities who contended that the original air power budget submitted to Congress was grossly inadequate.

The administration now agrees with the major points of this contention if not in full degree with the solution required. Before the Fiscal 1957 Defense Appropriation Bill reached the House of Representatives floor for debate and vote the administration asked for a \$447 million boost including the key area of B-52 procurement, early warning radar network and missile research. At the same time about \$19 million was shaved from the frozen funds of the Defense Department emergency account and made available for Air Force research and development.

#### House Approved Boost

With this substantial boost included in the bill the House unanimously approved it in a vote of 377 to 0. An ill-considered amendment by Rep. Dan Flood (D-Pa.) to tack on another billion dollars for B-52 procurement was nipped by the more thoughtful members of the House.

For the problems that now remain in the airpower budget cannot be solved by additional procurement funds alone. It requires more personnel and construction funds before USAF can recruit and maintain its new aircraft properly and meet research and development funds to keep its technical pace at maximum speed.

In addition to conceding its critics the half billion dollar budget boost, the administration is now trying to overcome the American people's bias and will keep repairing airpower.

There has never been any question that we now have the most powerful airpower in the world. The big question is whether we will maintain a significant margin of superiority in the future.

After having crossed military expenditure higher over Washington since the Eisenhower was inaugurated in 1952 for alleged safety and economy reasons, the Defense Department has now authorized the largest man flight in history over the Capitol on Armed Forces Day.

It has begun to transport the strength of the total military airpower available from the Army, Navy and Marine in addition to the Air Force. This is a drama with which nobody can quarrel. However the specific contribution of these other services air forces should be examined in detail to determine in what manner and degree they con-

tribute to the main airpower mission of secure national and its secondary mission of a war defense.

#### Senate Research Debate

Airpower debate in the Senate will probably center on the increasing dependence on research and development and its facility construction funds. It is apparent from testimony before both House and Senate Appropriations Committees that all of the top USAF and military leaders except USAF Secretary Donald Quarles agree that more research and development funds are an urgent USAF requirement. It appears doubtful that the Senate will let Secretary Quarles single-handedly veto all USAF requests for more research and development money stand—particularly since it is a small but significant amount totaling not more than \$206 million. It also is likely that some additional construction money will be attached to the military public works bill for Key Strategic Air Command bases and research and development test facilities.

Thus it appears that the Fiscal 1957 airpower budget will emerge from Capitol Hill considerably stronger than when it was submitted in January. It also appears that most of the critical patches such as B-52 production, research and development and facility construction will be much relieved. There is no doubt that it has paved the way for further cuts to hold its airpower level for another year.

#### Next Year Critical

However, it is apparent that the really critical battle of the budget will occur over the Fiscal 1958 budget just a year hence. Both USAF and Navy officials have indicated that the Fiscal 1957 budget level has been achieved by a variety of "one-shot" concessions that cannot be repeated in the future, such as having only 10 monthly aircraft production instead of 12, postponing necessary base and test facilities construction and slowing research and development.

USAF Secretary Donald Quarles has made it unmistakably clear to both the House and Senate Appropriations Committees that a major increase in the Fiscal 1958 airpower budget will be required to continue expansion of USAF to its 137 combat wing program and maintain its qualitative superiority. Similar increases on a smaller scale will be necessary for most aviation as its technology comes of age.

The Fiscal 1957 battle of the airpower budget is virtually won. It is toward the more critical battle looming for Fiscal 1958 that the American people and its Congress should begin to direct their attention.

—Robert Hoar

The North American Super Sabre  
thanks for alloys of titanium steel

# up on its tail—of TITANIUM

Most of the tail section and many other vital parts of North America's F-100C supersonic fighter are made of titanium. It not only reduces gross weight by several hundred pounds, it withstands the soaring combination of engine and aerodynamic heat.

Titanium is no stranger to North American aircraft. The first F-300, F2-4 and earlier planes like the F-96D Sabre Jet and the F2-3 and F2-3Furor for the Navy all fly with titanium.

Here's why—Titanium's high strength-weight ratio—its freedom from stress corrosion cracking—its corrosion resistance—and its stiffness to withstand high operating stresses have made it an essential part of high-performance aircraft.

REM-CRU led in the development and production of titanium for aircraft applications. And REM-CRU's enlarged facilities mean prompt delivery of the titanium grades, sizes and shapes you need—including new high strength, reliable alloys. What's more, REM-CRU is always glad to share with you the wealth of titanium data it has available.



Men working REM-CRU  
jet engine tail section.

To keep ahead of the latest developments in the metal game, write to Dept. 445 for the *Rem-Cru Review*—a free periodical presenting the latest technical data on titanium alloys.

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## WHO'S WHERE

### In the Front Office

George McGee, executive vice president  
Stanley Laboratories, Inc., Long Island  
City, N. Y. Also named to vice president  
posts: General Managers R. G. Rodden, En-  
gineering Director E. H. Feltner and Sales  
Director W. J. McDonald.

Dr. Ralph P. Johnson, and Frederick  
C. Crawford, directors, Aero-Weathering,  
Corp., Los Angeles, Calif.

Dr. Charles E. Bonner, executive vice  
president, Ford Instrument Co., New York,  
N. Y., effective July 1.

F. J. Gaffney, engineering vice president  
Telegraph Corp., Stamford, Conn.

### Honors and Elections

Vice Adm. Charles E. Rosenthal, USN, ret., has been awarded a Certificate of Merit from the Air Force for his direction of National Air Transport Corporation's continuous delivery program including volunteer plane donations.

Dr. Carl Ernst J. Fuchs, USAF, commander, 20th Weather System, and Vice Robert C. Miles, USAF, senior in charge, Rome, Weather Division, Kansas City, Mo., have been presented with the American Meteorological Society's Mendenhall Award for their numerous studies of the present and potential progress of tornadoes and other destructive local storms.

Two international awards will be given soon by Geneva, Switzerland. The first is the 1956 award of \$1,000 and a plaque for the solution of the most important international public relations problem concerning the aviation industry during 1955. "Best of contribution in improving news in jet aircraft between now and delivery of the first commercial transport in 1958." Second award, \$500 and a plaque will be an annual presentation for solution of an aircraft engine or structural maintenance problem.

### Changes

F. C. & Cook, director, Ford Air Force  
Fighting aircraft research and development  
Ministry of Supply. He succeeds Air Com-  
modore J. A. Hawkins.

Robert S. Babin, chief engineer, Melpar,  
Inc., Tulsa, Okla., Va.

William D. Ott, military relations &  
technical manager, Lockheed Aircraft  
Corp., Missile Research Division, Van Nuys,  
Calif.

Walter K. Holden, areas development  
engineer, electronic systems research, Dallas,  
Dallas Consolidated Electronics  
Corp., Pasadena, Calif.

Dr. James Raynor, director, Atomic  
Molecular & Plasma Research, Be-  
man Research, Chicago, Ill.

John C. Hixon, in charge, Hercules Air  
leak sprayer and ultrasonic alloy alloy.

Leon E. Silverman, general manager, The  
Engineered Division, Consolidated Diesel  
Engine Corp., Stamford, Conn. Also  
John A. Laska, general technical manager  
(Continued on p. 177)

## INDUSTRY OBSERVER

► Ten major aircraft companies are waiting out USAF evaluation of their dual-propulse for the medium-range intercept competition. USAF is due to award Phase 1 contracts for the medium-range intercept soon. Plans that this competition might be canceled due to research and development fund limitations have been cited by the USAF decision to award the long-range intercept and fighter bomber Phase II programs. Medium-range intercept contracts are only for testing; interceptors about 500 miles out is compared with the 1,500-mile strike range of the long-range interceptors.

► Douglas F3D prototype is in Phase I flight testing at Edwards AFB with Robert Rabin, company test pilot, at the controls. Large vertical fin is the main characteristic distinguishing it from the F4D, but it is powered by a General Electric J79 turbojet replacing the Pratt & Whitney J57 on the Skybolt.

► Joint Army-Navy intermediate-range ballistic missile project has been designated the Jupiter. Army has changed the designation of its Redstone 700-mile range missile to the Jupiter A and the new 1,500-mile range post project is designated Jupiter C.

► Boeing's T-104 transport has been assigned the NATO code designation Canad.

► First deliveries of the Douglas F4D Silver have been made to the Navy's Atlantic and Pacific Fleet air commands and to the Marine Corps. The F4D has qualified on all three types of Navy heavy attack carriers—the Forrestal, Intrepid and Midway, class—and has recently completed its first intermediate test program. Initial deliveries of the F4D are being made with radar equipment and fire control that will be further modified to provide full all-weather capability in mid-summer. F4D has demonstrated full performance for high speed and maneuverability performance at altitudes well above 55,000 ft.

► General is developing an extensive series of development test equipment for its Atlas intermediate-range missile program including a continuous-wave radar high-altitude tracking system.

► Lockheed's solution to pilot survival in supersonic bailout is the F-104's downward ejection seats at just the critical structure going with the seat to protect the pilot from aircraft. Not believing a jettable seat pod, Lockheed has made the jettable portion a part of the seat structure. Tests are scheduled for early this summer at Hawthorne, Nev. as part of Project Scout.

► Phenolox, a visual stress analysis tool, is being imported from France for propeller balance and stress reaction in multiple dynamic gust loads. A thin layer of clear plastic (probably epoxy) is applied to laminated on the airframe and the stress patterns are measured through a polaroid.

► Lockheed has developed a three-stage hypersonic test vehicle for ballistic missile research designated the X-17. It was solid propellant rocket motor.

► Joint Air Force-Navy program is under way to develop expendable plasma for externally-mounted wing stores. Concept calls for burning hypersonic aircraft with an aerodynamically clean wing after using externally carried fuel and disposing of externally-mounted equipment. Current practice is to use fixed pins for mounting these expendable items.

► Charles Wright dual cycle engine combining turbojet and ramjet power plants has made successful transition from sea plane to altitude in full scale wind tunnel tests at a high altitude flight conditions. The dual cycle engine is scheduled for the Republic F-105 experimental research aircraft.

► Bristol BE35 turbojet engine is named Orion, after a hunter in Greek mythology. Production goal is early 1957.



# Service Chiefs Hedge on Budget Support

Twining, Burke say more R&D funds could be used effectively; USAF doubts Navy's strategic role.

By Katherine Johnson

Washington—Top Air Force and Navy officials last week began to hedge when asked for the administration's support budget for Fiscal 1977. In testimony before the Senate Appropriations Subcommittee on the Armed Services, their facts came out.

• Gen. Nathan Twining, USAF Chief of Staff, and Chief of Naval Operations Adm. Adolph Buxie, testified that additional funds for research and development could be used "effectively" in the coming year.

• Both Secretary of the Air Force Donald Quarles and Burke agreed that heavy appropriations for aircraft and related procurement would be required in fiscal 1977, in view of numerous one-time savings in the fiscal 1975 budget, such as a scheduled reduction in procurement funds.

• Twining recommended an additional \$275 million for jets and other construction—much, he emphasized, in the west homeland, in the 113 wing program along with technical support.

• Twining challenged Navy testimony that raised support "significantly" in the current's strategic position and that there are "very few" signs out of reach of the Navy's attack bombers. In the aerial and ground phase of a carrier war, Twining declared, the Navy's contribution to the strategic air capability would be small.

• Army's Chief of Staff, Gen. Messell D. Taylor, testified that the USAF's

program to earn loans with the Navy developed. Taylor made was making the Army's no defense mission. Sen. John Stennis (D-Miss.), a member of the Appropriations Committee, declared that he will "stand" as a test of the service chiefs of the Twining and the Army's high-minded N&A in combat, both in the development stage, before any funds are used for their procurement.

## House Approval

The Senate Subcommittee opened hearings after the House approved, 377 to 0, the administration's program providing \$15.5 billion for the USAF and \$2.3 billion for Navy aviation (AW May 24, p. 27). An amendment offered by Rep. Daniel Flood (D-Pa.) adding \$1 billion for B-52 procurement was voted down on a 218-195 vote. Flood cited the testimony of Gen. Curtis LeMay, commander of Strategic Air Command, that strategic air superiority would pass to the Soviet Union within four years, unless the B-52 program were stepped up.

Leading the opposition to Flood's proposal, Rep. George Milner (D-Tex.), chairman of the Appropriations Subcommittee on the armed services, declared "who could a portion of fiscal responsibility... if we could say our biggest and bring into being today 1,000 additional B-52s, we would not necessarily be a great deal better off. We would not have the men to man them, the weapons and technicians." During the House debate, Rep.

I. Messell Rees (D-S. Cal.), led at the administration's \$5 billion shift in USAF funds—primarily for manpower and construction—in 1977, declaring:

In 1975, the USAF had 106 wings, supported by 677,000 military personnel. In 1977, USAF is supposed to have 177 wings, 1.4 million and maintain the force. USAF is expected to do so with 950,000 personnel. Even a case like this could not be made in any possible instance such as this.

In 1970, USAF had only 47 wings and 173 bases in the U.S. In 1975, the number of wings had increased 160%, the number of bases, only 40%.

## Senate Testimony

When the hearings opened in the Senate, there were among the highlights:

• Quarles testified that the Air Force is considering contracting with private organizations and industrial firms to supply the technical maintenance personnel at its bases in a possible step towards offloading the active business charge. He said, however, that he preferred military personnel which could be required to move with operational units.

• Quarles and Twining countered Gen. LeMay's testimony before the Armed Services Subcommittee, headed by Sen. Stuart Symington (D-Mo.) emphasizing requirements for B-1 production by pointing to B-57 both as the largest and most powerful vintage bomber force on conference. LeMay had cited the Russian jet bomber as comparable to the B-52. Twining said the B-57 is "the best long-range bomber in the world today." Under questioning, he also said he wanted no additional funds—over and above the administration budget—for B-52s.

• The total cost of the B-52 program, including research and development costs, is \$57.7 billion, it was disclosed. Of that, \$2 billion was in the fiscal 1977 budget—about a third of the total \$7.6 billion for all aircraft and ground-based procurement and modification.

• Of the total \$1.6 billion for Department of Defense research and development activities during fiscal 1977, \$127 million is for contracts in the field of aircraft and ground control and related equipment.

• A total \$5.2 billion is earmarked for research and development, plus production engineering. Over half of that, \$1.6 billion plus, for various projects. That is divided: USAF, \$1.4 billion; Army, \$357 million; Navy, \$775 million.

• Dr. Clifford C. Furness, Assistant Secretary of Defense for Research and



## Navy Tests Supersonic Fighters But New Aircraft

can't be operational for quite a while. Chance Vought's F-15B evidence was in closed position. One prototype crashed shortly at Edwards AFB. The Grumman F-119 on the deck edge of the Forrestal (below) has its wing tips folded down, wing slats bent out on each side for carrier deck landing.



## USAF Cancels Interceptor, Fighter-Bomber

Washington—As Congress wrangled over its fiscal 1977 budget requests last week, the Air Force decided to shelve development contracts for a long-range interceptor and a new type fighter-bomber. The probable reason, a lack of research and development funds, both general and targeted.

Hidden but in the decision, inherent by Avionics Work on Feb. 15 to 20, was North American Aviation, Inc., which had been participating in both the intercept and fighter-bomber competitions. Northrop also had entered in the intercept competition. Republic Aviation was participating in the fighter-bomber project.

After the Air Force decision, announced in the affected research firms in news telegrams, Clifford C. Furness, Assistant Secretary for Defense for Research and Development, indicated before a Senate Appropriations Subcommittee that the long-range interceptors probably was the most serious case to call from R&D funds.

Formerly studies, Furness testified, showed that the interceptors would have many weight characteristics. In addition, he said, a "higher performance" project—probably a medium range interceptors—already was under way.

Also, there was some doubt as to whether a long-range interceptor, with a 1,000-mph combat miles could fit into the present continental defense with its actively discharge radar warning system.



## USAF Report on Soviet Airmen Shows High Pay, 'Exalted' Status

Washington—The Soviet military can generally recruit a more exalted position within its own society than the U.S. or Russian civil and Russian air force pilots and technicians can ever better their Red Army counterparts.

A U.S. Air Force study concludes that, contrary to conditions within the U.S., it is as unexciting to belong to the service in Soviet Russia, particularly in the air force. Some of the reasons:

- In the Soviet air force, the member occupies a relatively high social status.
- Pay, housing, food, clothing needs, cell care and privilege are equal to or above that enjoyed by the ordinary citizens of similar experience and training in civil life. Special privileges enhance purchasing power.

- Military life is made more popular by the fact that it is more socially prominent with the importance of his job, regardless of rank. Long service affords substantial security for future life.

• The Soviet recognizes the technician within the military structure as its important person. He is paid on the same relative basis as the technician employed in industry.

- "Strong the state in a military status is considered to be an honor and the military man enjoys privileges not accorded to civilians. Consequently, there is little incentive for military personnel to seek civilian employment."

In this country, the rapid flow of technological talent into the service, into better paying civilian jobs is receiving great attention from the White House, the Pentagon and Congress.

For educational rates for technicians are well below those for nonmilitary civilians.

### Standard of Living

The Air Force study is based upon the limited information available from behind the Iron Curtain. It points out that comparisons are "extremely difficult" because of the differences between the economic status of a technician in the United States and the free enterprise system; the rate of exchange between rubles and dollars; and the more exact relative value of the ruble in terms and standard of living.

The study concludes that "the standard of living of the U.S. Air Force or Army member is undoubtedly better" than that of the Russian soldier—but

relatively speaking, the Russian stands higher in his society.

Russia's treatment of the pilot and the technician are particularly noteworthy.

In the Soviet air force, pilots and technicians (both civilian and military) are the only cited personnel who receive flight pay. It is stated that "this income double could be lost on a long flight status since 1948. This statement permits their income double-time could be lost in periods on long trips."

Regular pay for pilots and technicians is broken into three categories, based on experience and training progression. In addition, they receive flight pay and pay for "special practice" (parade flights). Extra flying pay is awarded for each hour per day, more-the-higher the right flying the most for status and the lowest for formation time.

Up to 40 parabolic jumps per 25 rubles (approximately \$6.25) per jump. From 40 to 250 jumps per 50 rubles per jump and above 250 jumps 100 rubles per jump.

### Maintenance Challenge

Russia also clearly has the same problems that plague the U.S. Air Force in technical areas, but the study indicates that the USSR has done more about it. From a variety of data of pay based upon the assignment. This applies to civilian men as well as to officers.

Assignment pay reflects Soviet respect and recognition for technical ability. The study says "Qualified in the technically oriented category are such personnel as engine mechanics, engine and aircraft mechanics, electronics, and aircraft specialists communications operators and radio personnel."

Aircraft mechanics reportedly receive 500 rubles per month irrespective of rank. All personnel above the grade of junior sergeant receive similar allowances while engine mechanics the USSR.

Mechanics and radio mechanics receive 1,000 rubles, while engine mechanics and radio mechanics receive 1,500 rubles. Those with superior ratings which exceeds without fault during the specified periods of time. In World War II, the study says, Russia paid bonuses of 1,000 rubles for each fighter specially damaged and 500 rubles for each bomber. Ground attack and fighter pilots were paid a bonus for each mission.

### Incentive Pay

Assignment and incentive pay, does not exist in the U.S. Air Force, "the study points out. It also says USAF does not provide incentives, awards for special achievement. Personnel receive pay for their grade without special consideration for relative efficiency or performance."

The USAF's "incentive pay" proposal to the Defense

Department for consideration.

Incentive pay (the service in distant areas) may be paid to Russian officers at the rate of two months for one month, or one-and-a-half for one, depending upon the degree of isolation. In addition, some incentives pay is the same as that for U.S. pilots. (The study notes that the Defense Department is now studying a USAF pay pool for remote and isolated duty pay.)

Army officers and career military men in Russia are awarded a high degree of respect, but apparently not the same degree as awarded the Air Force fighter member on "long strikes," the study said. "It is stated that incentives pay is lower for Army personnel although base pay and longevity are similar."

In military, some military and naval units are designated "guard units" as a military for various reasons. This includes officers to an extra \$100 assignment pay and called units to an extra 100%.

The study includes a comparison of facilities, using a hypothetical Soviet member who is in Class 1 (pilot and navigator) with 12 years service and a USAF member with similar responsibilities and service.

It shows that the USAF member draws his base pay and longevity (\$49,920 a month as compared with \$34,515) and higher quarters allowance and flight pay, but he has:

- No assignment pay. The Red member gets a 1975's month.
- No maintenance pay. The Soviet member draws \$370.50.
- No additional longevity or retirement credit for his flight status.
- No retirement pay, or similar credit for retirement or early flight pay. The wayward, no hot tobacco units no uniform allowance, no family health benefits, no housing furnished after retirement and full as much less.
- No social security in pay. USAF's form and retired men pay receive two-thirds Soviet retired men are exempt from income tax in such and officers receive certain social considerations.

## Northrop to Build Supersonic Trainer

Washington—Northrop Aircraft, Inc., has been awarded a contract by the Air Force for a supersonic jet trainer for the first time. The Air Force and it would have a "pure" jet trainer with performance matching characteristics of supersonic aircraft.

Whitely C. Collins, Northrop president, and the team celebrated two years of engineering effort by Northrop as its own funds. Northrop plans to establish the plant at its main plant in Hawthorne, Calif.

## Russian Technical Threat Dawns Slowly on U.S., Stever Warns

Berlin—The U.S. has been slow to recognize the fast-growing technological threat posed by the Soviet Union and is "just beginning to face up to the multiple task of mounting current strength of improving our strength for years ahead." Dr. H. G. Stever, USAF chief scientist, warned last week.

Despite earlier warnings such as an analysis by the New York Times published two years ago, Stever told the National Science Foundation. "The electronics, the nation has been reluctant to recognize that 'Soviet technical education is good in training technicians and scientists and is having a large number of engineers' than we have."

The USSR, he also challenges the U.S. in the "establishment of laboratories with the necessary complex equipment for research and development and the stimulation of the work of these laboratories in a concerted effort to make the Soviet regime in the technological world."

Stever cited key key factors which determine our capability to perform research and development:

- Scientific manpower.
- Specialized facilities for research and development.
- Organization and management.

Pointing out that an "increased and advanced public can help to improve our position in even one of these four factors," Stever expected the response of "thinking people of the U.S. are now moved by the necessity of doing something to strengthen our position in these four factors."

Public reaction and efforts to move funds and a more streamlined management of important programs, such as the long-range ballistic missile have made themselves felt quickly. As proof, Stever cited recent statements by members of Congress and means for research and development funds will be greatly quickened, wherever possible, and the most central source of private program management.

However, Stever cautioned that "many years went elapse before a group of students (concentrated by public efforts) emerges as trained scientists and engineers, and their influence in the government takes still longer to be felt."

Facilities which compete one of the biggest bottlenecks in almost all of our large scale aviation, development programs take a long time to plan, design, construct and test, and at its main plant in Hawthorne, Calif.

on the part of the public cannot greatly influence this."

Stever urged ingenuity and accuracy to help advance either separately or the security of this need for long-term continuing attention to the problems of scientific manpower and facilities. Stever contrasted the role of aviation today with its position 15 years ago, when it was considered much in "military equipment." Today the aerospace industry has become a full partner and its problems are treated as a part with those of propulsion, aerodynamics and structures, Stever said.

We have now arrived at a considerable understanding of the problems of integrating electronics into aircraft and we can look forward to an era when we will see real as well as great contributions to aircraft mission performance, Stever said.

Aircraft will make greater use of radar and radar in order to give aircraft and ground targets at greater distance in good weather or foul. It is night, Stever predicted. Computers will take over more and more duties, because of greater aircraft speeds and increased mission complexity.

Speaking of ground-based aircraft, especially for air traffic control, Stever said the proposed joint team being organized to "solve engineering problems." He added that in many cases, "political difficulties are as great as the technical."

## Douglas DC-9 Design Will Use J79 or J52

Santa Monica—The DC-9, wide-body transport addition being offered to the airlines by Douglas Aircraft Co., will be built around either the General Electric J79 engine or the Pratt & Whitney JT3 engine.

The J79 is a 13,000-lb. thrust engine that is being used in the Lockheed F-104A Starfighter. The J52 was developed originally as a Navy engine with a thrust in the 7,500-lb. class. (See specifications of the DC-9 on next page.)

Performance studies of the DC-9 have been presented to the airlines.

It is believed that the DC-9 is at least equally behind the Conquest Skyhawk in design development. The DC-9 is being offered as a competitor, proposed to the Skyhawk.

The Skyhawk (AW April 9, p. 90) is designed to use the J79 engine and would carry a first-class or 90 seats and cruise on lights at 2,000 ft. cruising speed would be 690 mph.



### Farmer in May Day Flyover

Five Farmco's by one Red Square during the May Day observance at Moscow. Though aviation display was reportedly not shown during the observance, the Red Square event. Farmer, capable of speed is believed to use two jet engines and has 400 hp, eight hp and a four-stroke jet.





## Defense Wants Small Businesses To Have Fair Share of Contracts

New York—The Department of Defense is entering its drive to give small business a fair share of defense work. Representatives of Defense, Congress and six large companies—the Small Business Corp., a division of the Small Business Administration, and the Small Business Administration, have the Army, Navy and Air Force.

The director of small business in the Department of Defense, John Hinkle, said small plant participation in the defense program is increasing slowly but he would like to see more of it.

### Some Shrinker

In fiscal 1973 small business received 39.1% of prime defense contracts, in fiscal 1976 26.2%. This means represents \$140 million a year in defense work. Hinkle said this rate is about the same for subcontractors.

Rep. Abraham J. Maltz (D-N.Y.), a member of the House Small Business Committee, told the conference that drawback is that many small agencies never have done any government business and shudder at doing so. "They still have an aversion to it," he said. "Many a Mr. Small Businessman does not realize the size of this government procurement effort like there is no sign made with him on."

Hinkle suggested that small business

also contact the Defense Department to qualify for the small business holder's list.

Once on the list, the small enterprise can be selected for bids on defense contracts. Even if he is not on the list, the small enterprise should go to the regional procurement office and check the bidding board. It is not necessary to be on the bidder's list to receive bids on contracts.

Odell Coughlin, Hinkle said, the small contractors can bid very successfully against big operators for certain type of work. "When qualified to be a contractor, I'd say the little guy gets the bid about 75% of the time. His costs are lower and he's more flexible."

Wide distribution of defense contracts to small enterprises seems desirable to Hinkle for better defense in case of atomic attack.

### Do Good Job

James Matton, production planning manager of Sperry Gyroscope and the company's small business liaison officer, agreed with Hinkle as to small enterprise efficiency. He said Sperry may be easily rated a holder of 20 prime contracts because the small business market could handle the work at lower cost.

Without small suppliers of components and assemblies, Matton said,

Sperry simply couldn't do the job. "They contribute, despite insignificance and inconspicuity in supplying quality goods at the right time and the right price," he said. Of the 4,365 suppliers, 5,216 or about 70%, are in the small business category.

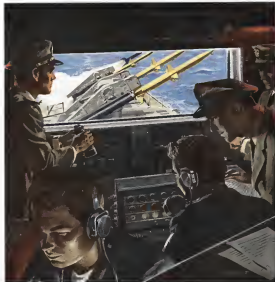
Of \$42.7 million let by Sperry as subcontracting, businesses of less than \$500 million received \$12.4 million or about 30%. About \$21.6 million went to 1,530 businesses of more than 100 employees and \$8.7 million to affiliates.

## News Digest

Navy's second guided missile submarine, *Bethon*, was scheduled to join the Atlantic Fleet at Norfolk, Va. Barb Barbers and its predecessor, *Taney*, are supposed to hit the Chinese Vought *Rapides*.

India's Defense Ministry says its decision to buy 40 Canberra jet bombers "is subject to the condition that they be fitted with some special equipment which meets the needs of the Indian Air Force." An Indian spokesman says an Englishman is influenced favorably by British Ministry of Supply decision to reject the "Waco trade" and buy right.

Lieutenant Commander Lino Giovanni Antonio for indicating the site hole of an aircraft in flight has been granted to Officer Glikko di Milano S.P.A., of Milan, Italy. Also included



## The Terrier...Navy Man's "Best Friend"

Just like its wiry namesake — the Navy's new anti-aircraft missile, the Terrier, has the built-in ability to track an aggressor. Once unleashed, no evasive maneuver can save invading aircraft from this obedience-trained supersonic watchdog.

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Navy Guided-Missile Cruiser: USS Canberra

Navy's second guided-missile cruiser, the Canberra, is shown under way at the start of her sea trials. Commissioning is scheduled for June 15. Major changes from the USS *Bethon*, under ship construction, let her (NAVY News 7, p. 14), is the external appearance of the guidance system mounted above and forward of the Terrier launchers. Major release of Soyuz missiles tested in the overboarded gas batteries.

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in agreement on manufacturing rights of low stability auger-type system.

Army awarded a \$2.6 million contract to Beech Aircraft for 1.13 Comma Transport, military version of Beechcraft Twin Bonanza executive airplane. Deliveries will begin in December and extend through May, 1957.

Convair personnel working with Navy's Bureau Aeronautics Air Station will enter the XT-1 Page to flight status. Plans was moved to Bureau following factory overhaul.

Western Air Lines plans to sell 55 million in debentures as part of \$48 million equipment financing program. Western also will borrow \$4 million from a bank group headed by the Bank of America and \$12 million from Prudential Insurance Co. of America. Balance of funds will come from net earnings, depreciation and proceeds from sale of surplus assets.

L. B. Smith Aircraft Corp. of Miami purchased sole ownership, manufacturing and sales rights to recently approved Transport Category airplane C-46/W-46T. Plane was developed in cooperation with Air Center Engineering Division of Miami. It now is under evaluation by several airlines for use as replacement for DC-3, Smith assumes final test.

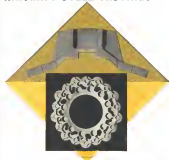
An international congress on rockets and guided missiles will be held in Paris Dec. 3 through 6. The Association Pour l'Enseignement et la Recherche Aéronautique is sponsoring the eight day discussion which they expect will include representatives from the United States, Great Britain, Germany and Italy.

USAF's Northern Air Materiel Area is expected to sign a contract with Fuji Heavy Industries Ltd. of Japan for 20 strike aircraft for the Japanese Ground Self Defense Force. The Mutual Defense Assistance Program will pay \$12 million for the aircraft, which is Fuji's modification of the U. S. Beechcraft Model.

Lockheed Aircraft Service increased basic rates 6% for some 400 employees. Most employees received an increase ranging from 4 to 6%. Increases and benefits follow pattern of Southern California aircraft industry.

Lockheed Aircraft engineers received a 6% general increase in salary retroactive to April 5 and an additional 1% increase for next year. The contract terms were outlined recently by the Aircraft Chapter of the Engineers and Scientists Assn.

## LEBANON'S NEW CERAMICAST PROCESS NOW IN QUANTITY PRODUCTION OF TWO AIRCRAFT STEEL CASTINGS



...the **RENK 142543**. The landing gear for the Renk die-type aircraft brake was previously fabricated in light alloy materials. When increased heat and stresses made it mandatory to change to steel, Lebanon was given the assignment. Landing plates were redesigned as cast steel parts and are now in quantity production in Lebanon.

...the **CHANGE VOUGHT 16-0000-1**. This support fitting for a jet engine removed shock in the Chance Vought C-119 was originally produced as a machined part. When quantity production met this new requirement, Lebanon's CERAMICAST Process was able to meet all requirements satisfactorily at a considerable cost saving. The desirable characteristics of the original machined part have been successfully retained.

...OUR SERVICE TO YOU. The aircraft industry is finding increasingly wider use for the CERAMICAST Process. We invite you to send us your requirements or to visit our Plant in Lebanon. Our engineers will show you how CERAMICAST is adaptable to your present design.

WRITE FOR CATALOG: LEONARD Baskin and Chance Vought Die Makers CERAMICAST Technical Division



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see 100 Spots

CHICAGO to CLEVELAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465
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\*These are the rates for most commodities. They are often lower for large shipments. Rates change, and do not include the 3% federal tax on domestic shipments.



For service or information, call the nearest United Air Lines Representative. Write for free Air  
passage booklet, Bureau Sales Division, Dept. 15, United Air Lines, 1901 S. Dearborn Ave., Chicago 16.

### Airline Traffic—First Quarter 1956

	Revenue Passenger Miles	Revenue Passenger Miles (2003)	Load Factor	U.S. Mail	Passenger	Freight	Total Revenue Per-Action	Per Cent Return to Per-Action	
DOMESTIC TRUNK									
American	1,699,026	1,229,313	56.88	4,899,849	16,362,102	70,231,893	46.06		
Boeing	431,438	748,316	71.41	512,401	1,075,000	17,136,369	54.87		
Eastern	5,073,178	3,383,938	38.99	7,461,403	315,000	98,887,844	44.28		
Continental	8,819,118	5,383,384	35.80	48,311.3	18,187	1,288,310	34.92		
Northwest	1,011,271	1,383,386	73.15	1,487,519	75,000	18,816,814	75.37		
Golden Gate	504,252	878,071	57.32	891,269	645,450	7,888,418	38.91		
Western	1,238,556	1,044,051	84.34	8,893,817	1,837,426	13,443,567	71.37		
Midwest	415,317	313,760	75.55	570,000	390,338	5,474,606	58.46		
Southwest	700,888	803,886	86.21	391,081	33,330	8,801,470	35.18		
Northwest	2,955,171	1,810,148	37.74	1,016,909	636,182	1,053,518	34.84		
Northwest	94,985	67,485	70.96	1,089,478	3,673,233	15,418,318	54.89		
United	1,846,538	1,097,644	59.43	4,035,472	9,995,051	107,820,892	76.94		
Western	45,458	97,884	43.74	96,961	38,949	63,308	37.34		
INTERNATIONAL									
American	34,708	56,181	76.73	23,436	5,122	4,926,594	76.18		
Boeing	8,241	10,619	47.62	80,071	5,122	2,841,463	48.80		
Continental	21,217	4,030	70.77	3,463	11,768	381,254	57.63		
Eastern	4,508	3,347	74.24	8	8	420,564	40.49		
Golden Gate	19,187	10,370	53.92	88,729	6	1,844,838	47.22		
Midwest	45,460	56,000	80.87	178,449	808,547	7,836,485	71.68		
Northwest	25,750	87,994	71.65	55,340	11,000	6,188,417	74.85		
Southwest	13,347	48,178	32.23	8,874,138	22,169	9,950,001	66.18		
U.S. Airways									
Boeing	97,430	17,268	59.98	87,815	304,568	2,618,991	42.00		
Continental	134,695	297,831	36.78	8,850,490	1,609,817	25,551,381	29.81		
Eastern	407,770	178,183	43.74	3,282,648	1,621,051	19,147,891	43.89		
Northwest	301,793	536,172	65.77	707,139	1,146,101	15,756,796	61.91		
Boeing	33,026	49,190	59.19	146,065	1,227,874	3,446,990	29.55		
U.S. Airways	43,828	118,048	66.76	3,837,979	1,153,718	16,646,829	55.78		
U.S. Airways	10,361	46,849	45.96	371,001	1,900,876	3,440,490	61.90		
LOCAL SERVICE									
Allegheny	70,870	13,477	48.09	18,182	43,491	1,181,670	44.81		
Boeing	37,717	6,743	41.24	30,368	5,139	1,171,340	56.89		
Continental	84,025	17,468	47.83	7,803	18,120	1,649,481	47.63		
Eastern	10,740	14,946	52.57	53,965	87,035	1,888,775	41.89		
Golden Gate	14,049	4,898	34.00	8,889	89,630	1,439,181	41.89		
Northwest	12,148	22,119	55.19	18,387	23,945	1,338,282	54.57		
Southwest	77,024	16,487	30.65	50,980	95,020	1,708,384	44.51		
Continental	66,896	12,428	34.02	84,076	48,709	1,184,798	45.87		
Northwest	14,148	15,561	65.25	17,843	89,801	1,192,001	42.99		
Southwest	49,285	7,497	43.11	22,777	11,900	771,881	42.99		
Northwest	17,437	17,708	98.45	15,213	30,146	1,154,925	45.78		
U.S. Airways	40,185	10,475	18.99	30,209	68,821	1,185,384	31.78		
West Coast	46,214	3,599	42.58	18,818	6,936	820,635	31.78		
HAWAIIAN									
Honolulu	83,657	19,618	18.04	11,818	347,992	1,866,579	40.71		
San Francisco	37,058	4,701	48.87	2,668	87,447	1,000,340	43.85		
CARGO LINES									
American Ind. Air Service					1,065,798	1,905,786	68.80		
Fluair Tiger	10,649	34,183	38.23	71,800	15,640,179	20,121,916	70.07		
Rock Roller®	4,157	12,839	45.60	14,807	19,793,681	3,098,072	36.84		
HELICOPTER									
New York Airways	0,913	500	50.00	8,887	3,157	1,908	18,814	15.10	
Los Angeles Airways® Helicopter Air Service				4,958		0,538	46.78		
ALASKAN									
Alaskan Airlines	8,914	3,948	35.40	133,338	893,253	1,439,051	49.87		
Alaska Central	7,195	573	33.33	10,001	30,874	89,271	48.90		
Boon-Airways®									
Coastair	3,668	517	40.54	8,799	128,489	195,215	70.25		
Elm Air Lines	8,605	494	42.99	5,705	5,035	31,878	65.68		
Northwest Consolidated	3,338	54	1.50	1,113	1,084,000	1,084,000	32.32		
Pacific Northwest	4,072	399	39.10	43,898	49,409	188,328	34.87		
Reggie Airways	474	308	31.67	33,395	33,395	122,646	31.37		
Seascope	1,000	8,666	86.66	1,000	1,000	22,322	22.32		

\*Not available

Continued from AVIATION WEEK (see other reports in the Civil Aerospace Board)

Her name means "luxury" in many languages

Moving smoothly down the runway—this tri-jetted Boeing Stearman is about to take off on another routine over-ocean mission.

For seven years Stratoscramper has spanned the U.S. and landed four continents. They have made more than 30,000 overseas crossings. They have carried more than 36 million passengers and have flown nearly 300,000,000 miles!

To his proponents the Stratoslayer represents the acme of luxury and comfort, but to its critics, the Stratoslayer is, like all balloons, a far cry from the future. The Stratoslayer, they say, will be far eclipsed by the supersonic jet, the space shuttle, and the new air travel.

**BOEING**

Py 1400 One 314,338 0

**John-Tyler Keweenaw, E. F. McManahan** president and director \$15,400 salary and bonus and interest compensation; **J. E. Keweenaw** vice president and director \$11,500 salary (up \$1,000) \$40 bonus and interest compensation; **L. J. Keweenaw** vice president, \$11,000 salary; **M. L. Keweenaw** secretary-treasurer, \$10,500 salary (up \$1,000) \$34 bonus and interest compensation; **J. E. Keweenaw** assistant to the president and director \$1,400 salary (up \$1,000); **D. E.**

West Coast National Ins. With Ben  
president and chairman \$19,000 salary  
in 10 company vice president and director  
\$10,000 salary. P. A. Jones secretary  
insurer \$1,000 salary. E. E. Cook vice  
president \$11,000 salary (up \$1,000). T. E.  
Brown, vice president, \$8,000 salary.

See *Los Angeles Times*, p. C-1, 11/10/84.

1980-1981 \$11.00 salary; 1981-82 \$12.00 salary; 1982-83 \$13.00 salary; 1983-84 \$14.00 salary; 1984-85 \$15.00 salary; 1985-86 \$16.00 salary; 1986-87 \$17.00 salary; 1987-88 \$18.00 salary; 1988-89 \$19.00 salary; 1989-90 \$20.00 salary; 1990-91 \$21.00 salary; 1991-92 \$22.00 salary; 1992-93 \$23.00 salary; 1993-94 \$24.00 salary; 1994-95 \$25.00 salary; 1995-96 \$26.00 salary; 1996-97 \$27.00 salary; 1997-98 \$28.00 salary; 1998-99 \$29.00 salary; 1999-00 \$30.00 salary; 2000-01 \$31.00 salary; 2001-02 \$32.00 salary; 2002-03 \$33.00 salary; 2003-04 \$34.00 salary; 2004-05 \$35.00 salary; 2005-06 \$36.00 salary; 2006-07 \$37.00 salary; 2007-08 \$38.00 salary; 2008-09 \$39.00 salary; 2009-10 \$40.00 salary; 2010-11 \$41.00 salary; 2011-12 \$42.00 salary; 2012-13 \$43.00 salary; 2013-14 \$44.00 salary; 2014-15 \$45.00 salary; 2015-16 \$46.00 salary; 2016-17 \$47.00 salary; 2017-18 \$48.00 salary; 2018-19 \$49.00 salary; 2019-20 \$50.00 salary; 2020-21 \$51.00 salary; 2021-22 \$52.00 salary; 2022-23 \$53.00 salary; 2023-24 \$54.00 salary; 2024-25 \$55.00 salary; 2025-26 \$56.00 salary; 2026-27 \$57.00 salary; 2027-28 \$58.00 salary; 2028-29 \$59.00 salary; 2029-30 \$60.00 salary; 2030-31 \$61.00 salary; 2031-32 \$62.00 salary; 2032-33 \$63.00 salary; 2033-34 \$64.00 salary; 2034-35 \$65.00 salary; 2035-36 \$66.00 salary; 2036-37 \$67.00 salary; 2037-38 \$68.00 salary; 2038-39 \$69.00 salary; 2039-40 \$70.00 salary; 2040-41 \$71.00 salary; 2041-42 \$72.00 salary; 2042-43 \$73.00 salary; 2043-44 \$74.00 salary; 2044-45 \$75.00 salary; 2045-46 \$76.00 salary; 2046-47 \$77.00 salary; 2047-48 \$78.00 salary; 2048-49 \$79.00 salary; 2049-50 \$80.00 salary; 2050-51 \$81.00 salary; 2051-52 \$82.00 salary; 2052-53 \$83.00 salary; 2053-54 \$84.00 salary; 2054-55 \$85.00 salary; 2055-56 \$86.00 salary; 2056-57 \$87.00 salary; 2057-58 \$88.00 salary; 2058-59 \$89.00 salary; 2059-60 \$90.00 salary; 2060-61 \$91.00 salary; 2061-62 \$92.00 salary; 2062-63 \$93.00 salary; 2063-64 \$94.00 salary; 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2185-86 \$216.00 salary; 2186-87 \$217.00 salary; 2187-88 \$218.00 salary; 2188-89 \$219.00 salary; 2189-90 \$220.00 salary; 2190-91 \$221.00 salary; 2191-92 \$222.00 salary; 2192-93 \$223.00 salary; 2193-94 \$224.00 salary; 2194-95 \$225.00 salary; 2195-96 \$226.00 salary; 2196-97 \$227.00 salary; 2197-98 \$228.00 salary; 2198-99 \$229.00 salary; 2199-00 \$230.00 salary; 2200-01 \$231.00 salary; 2201-02 \$232.00 salary; 2202-03 \$233.00 salary; 2203-04 \$234.00 salary; 2204-05 \$235.00 salary; 2205-06 \$236.00 salary; 2206-07 \$237.00 salary; 2207-08 \$238.00 salary; 2208-09 \$239.00 salary; 2209-10 \$240.00 salary; 2210-11 \$241.00 salary; 2211-12 \$242.00 salary; 2212-13 \$243.00 salary; 2213-14 \$244.00 salary; 2214-15 \$245.00 salary; 2215-16 \$246.00 salary; 2216-17 \$247.00 salary; 2217-18 \$248.00 salary; 2218-19 \$249.00 salary; 2219-20 \$250.00 salary; 2220-21 \$251.00 salary; 2221-22 \$252.00 salary; 2222-23 \$253.00 salary; 2223-24 \$254.00 salary; 2224-25 \$255.00 salary; 2225-26 \$256.0

## CAR ORDERS

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Trans-World Airways is exempted to operate one daily round-trip flight between

Tussocks *Are* Lanes an exception to perform a light from Guam to Tulsa carrying school teachers from the Guam Public Schools.

City of Norfolk, Neb., and the Nebraska Department of Aeronautics permission to interview in the investigation of Boeing Aircraft service to pilots in the North Central States.

Agreements involving Pro American World Airways, Air India International and various other carriers relating to international arrangements.

**CHIEF:**

**DEVELOPED**  
 Term Coalitions Agencies and Publics Act

and application to operate between Miami and Ponce via San Juan, at the request of the applicants.

City of Greensboro, Colo., and the Green Mountain Chapter of Conservation

Follows Express Agency petition to suspend or defer tariffs filed under terms of the CNA's contracts on deferred no double

Frontier Airlines and North Central Airlines permission to intervene in the investigation of Braniff Airways' continued service to remote airports in the north central states.

Permits to interview were granted to the American Committee of the Nordfolc, Nels. Church of Commerce; the Airport Road of the City of Beavering, S. D.; the North Dakota Association of Commerce; the City of Mitchell S. D., and the Mitchell Church of Commerce; the City of Western, S. D. and the Western Church of Commerce; the City of Yankton, S. D., and the State of Minnesota.



# DILBERT NEVER HAD IT THIS GOOD

College graduates who join the new Navy Aviation Officer Candidate Program really have it made. Instead of going through flight schools as cadets, kept single by regulations, they are made ensigns after 4 months of preflight school. For the next 14 months, until they get their wings, they earn \$436.56 a month, more if married.

Dilbert never had it that good.

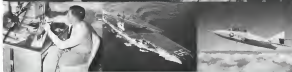
Come to think of it, many a civilian doesn't have it as good either. Figure the retirement pay these ensigns will draw after a mere 20 years. With maximum normal promotions (ensigns make "jg" in 18 months) they'll get \$280.00 a month for life. To get the same, you would have to pay \$35.00 a month for 20-years worth of \$80,000 endowment insurance.

As for travel, glance at George in the picture taken in Jamaica, B.W.I. Still single and only 26, George has already been to London, Paris, Madrid, the French and Italian Riviera, Rome, Hong Kong, and Tokyo.

You get all these benefits and more, plus a \$70,000 training to become a professional pilot. In return, you will be doing your country a service. For details about AOC and NavCad (only 2 years of college required) write: NavCad, Washington 25, D.C.

## GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Bethpage • Long Island • New York



Be an ensign in 4 months. The new AOC Program for college graduates, 17 to 24, puts you through 14 months of flight training as an ensign at \$436.56 a month.

As a Naval aviator you will travel the world on one of the Navy's new super-jetliners, or the newly modernized carriers with angled decks and close catapults.

New F11F-C Cougar, a two-seat modification fighter for carrier operations and superior flight, is a modified version of the Grumman F11F-B Cougar, standard Navy jet fighter.



The Grumman F11F-1 Tiger is a sleek new jet fighter capable of supersonic speeds in level flight and was the first airplane to fly with the new Area Rule "Coke bottle" fuselage.

The Grumman twin engine S2F sub killer, along with the carrier and shipboard, makes up the Hunter Killer Group, the Navy's counter-weapon against submarines.



Designers and builders of the superbly F11F-1 Tiger, famous F11F-B Cougar, S2F sub-killer, SA-16A all-weather missile, patrol boats, and A-1H truck loaders.



# Cline Electric

HELPS MAKE TRUTH OF SCIENCE FICTION



Rocketing into the future for a problem and solving it today, Cline Electric Manufacturing Company is helping to make the fabulous world of tomorrow come true. Developments such as Cline's wide-frequency-range **Magnetic Amplifier**, **Exter Voltage Regulator** and **Magnetic Speed Positioning Devices** for aircraft reflect Cline's ability as a leading designer and supplier of electrical and electronic equipment.

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## Shortlines

► **Air Transport** Asia reports U. S. scheduled airlines flew 331,732,000 revenue ton-miles in February, 84% more than in February 1955. Passenger miles were up 14.8% to 1,35,964,900 in the same period. Airways Clearing House handled \$158,721,659 in airfares between in the first quarter on increase of 16.6% over the 1955 first quarter.

► **Air Lines** carried 402,251 passengers in the first year ending in March. The London-Dublin service accounted for 175,695 passengers, as compared with 148,051 for the same period of last year.

► **Air France** reports traffic increase of 15% in passengers and 14% in passenger-miles for 1955. North Atlantic Division traffic increased 32% during the year, and the Air France western load factor was 71% for 1955.

► **Allegheny Airlines'** first quarter traffic increased by 27% over the same period for 1955 to 11.4 million passenger-miles. That number held the completion record to 84%.

► **American Petroleum Institute's** Aviation Technical Service Committee has set up a study of methods for fueling turboprop and turbopump transports. Particular attention will be given the DC-3, Boeing 707, Convair 440 and Lockheed Electra.

► **Braniff Airways** reports a net operating profit after taxes of \$362,580 for the first quarter of 1956. This is a record net profit for the airline and represents an increase of 25% over profit for the 1955 first quarter. Braniff has three routes include introductory operating losses in the new routes in Washington and New York.

► **British European Airways** had a profit of about \$1.4 million after taxes in the year ending March 31. During the year, BEA carried 2,250,000 passengers, had total revenues of \$68 million.

► **British Overseas Airways Corp.** increased passenger traffic between New York and London 25% to 54,828 passengers in the year ending March 31, 1956. BOAC will operate Super Constellation with Viscounts on a daily route at service from New York to Bermuda beginning May 1.

► **Canadian Pacific Airlines** will start service June 2 between Vancouver and Baguay Aves via Toronto, Mexico City and Lima.



Electronic Flight Board

Aerial rail departure times of some 250 flights daily are posted electronically on information board at Hopkins Municipal Airport, Cleveland, Ohio. The board installed recently in the airport's new \$6,500,000 terminal building was manufactured by Spence Display, New York, at a cost of approximately \$96,000.

► **Emery Air Freight Corp.** had net income of \$214,736, an gross revenues of \$2,017,543 in the first quarter of this year. Net profit for the same period last year was \$25,065 and revenues were \$1,909,865.

► **Ethiopian Airlines** has scheduled five flights a week this summer between Addis Ababa, Ghana and Addis Ababa with Convair 440 equipment. The airline recently completed negotiations with Sabena for the purchase of a third Convair 440 by the end of the first of next DC-3s.

► **Japan Air Lines** purchase of four DC-7Cs from Douglas' total orders to 145. Delivery is scheduled for early 1956.

► **Mohawk Airlines'** first quarter traffic increased by 35% over the same period of 1955. The load factor reached 55.21%. Mohawk carried 25,605 passengers in April, 31% above the previous April April. Load factor increased to 57%.

► **North Central Airlines** carried 41,131 passengers in April and 153,508 passengers in the first four months of 1955. The January-April traffic increased 50% over the same period last year.

► **Oriskany Air Lines'** April passenger traffic showed a 28% increase over April, 1955. The airline flew 36,701 passengers last month and reported a four month total of 91,295.

► **Pan American World Airways** reports 54,480 passengers traveled through its Miami gateway in April as compared with 44,699 in April of the previous year. During the month, 25,657 passengers departed for Latin America and 30,331 returned.

► **Riddle Airlines** flew 7,736,016 lb of cargo during the first quarter of the year as compared with 5,533,029 lb for the same 1955 quarter. Cargo traffic in March was 3,355,144 lb, a 64% increase over the previous March.

► **Seaboard and Western Airlines** flew 5,715,000 cargo ton-miles in the first three months of 1956, an increase of 75% over the first quarter of 1955.

► **Southern Airways** flew 15,038 passengers and 2,73,954 passenger-miles in April as compared with 14,407 passengers and 2,48,563 passenger-miles in April, 1955. The April 1956 load factor was 47.8%.

► **Trans-Atlantic Airlines** has taken up its option on two Vickers Viscount 510D transports for mid-1956 delivery. The order brings total Viscount sales to 506.

► **United Air Lines** has ordered an \$800,000 DC-8 simulator from Link Aviation, Inc. The simulator will be installed in 1956, about a year before delivery begins in United DC-8 sales. United flew 366,215,000 passenger-miles in April, a 10.5% increase over the previous April.

# AERONAUTICAL ENGINEERING

## Patuxent River Tests Navy Aircraft for

By Dale W. Cox, Cdr, USN\*

Patuxent River, Md.—Four decades of the Naval Air Test Center have been the last word on the suitability for flight use of all the Navy's new birds, and its testing aircraft.

Patuxent is to meet another vital challenge: Light and Weight Performance All-Boat to the Air Force. The Air Force maintains an equally strong interest, but the Navy feels there is an advantage in having all test work on the same base. Project pilots from the four divisions personally run computer tests at intervals through the test flying program.

These are the four divisions and their functions:

- **Service Test** checks the operational and tactical suitability of the airplane in a fighting machine for the fleet, giving particular attention to maintenance.
- **Flight Test** evaluates stability and control, performance of the plane and engine, and the carrier suitability.
- **Armament Test** determines the ability of the aircraft as a weapons platform.
- **Electronic Test** conducts a technical

\*The views expressed in this article are those of the author, and not necessarily those of the Navy Department or the Naval Service as a whole.



GROUND TESTS: crewmen record data from a test bed run by an F4D-1.

evaluation of all avionic equipment. Soon after the first flight of a new airplane, the Navy sends a pilot team from Patuxent to the contractor plant to fly the new craft. That is a Navy Performance Evaluation, a brief, formal series of tests to discover any major discrepancies in the experimental model prior to sending production planes to Patuxent. Of primary interest are qualitative questions on stability and control and rough quantitative data on performance.

### General Test

Contractor instrumentation on the X model is used to find true angle, rate of roll, lateral stick force, and other information necessary to size it for control systems, or flying qualities and performance. The Flight Test Division of the Naval Air Test Center is responsible for the evaluation and the written report to the Bureau of Aeronautics (BuAer).

Typical forms of trouble that tests uncover:

- Poor location of instruments or equipment. (The Mock-Up Board prohibits holes in paper covers of equipment. When pilots want to use the tape inside, this often leads to more itchy scratched differentials.)

- Poor handling and controllability in the carrier approach attitude.
- Unacceptable high speed characteristics.

After the first look, the contractor, BuAer and Patuxent decide whether the shipments require fixes prior to delivery. Section studies pass along which the contractor's pilots are busy increasing the flight envelope and the engineer's came up with changes requested in the first rehearsal.

Again a Navy Performance Evaluation is required and Patuxent pilots fly the modified experimental model. A second report of these qualitative tests is made to BuAer and additional fixes may have to be incorporated into the X model and the production line. Should this second evaluation indicate, on the other hand, that the plane is ready for its formal tests at Patuxent, no further tests are made by the Navy at the contractor's test facilities. Contractor pilots continue to increase and demonstrate the flight characteristics of the airplane until a series of tests called SR-1 Post-1 Demonstration have been completed. Then the Navy is ready to flight test the airplane at Patuxent.

### Y Models

When the first seven flights roll off the production line, the six designated Y models are picked up by Patuxent pilots for the Bureau of Inspection and Survey (BIS) trials. BIS is an organization independent of the Test Center to inform the Commandant of the Naval Air Test Center reports the results of the trials made on each new model airplane. The Board of Inspection and Survey, in turn, reports directly to the Secretary of the Navy on the suitability of all ships and airplanes bought for the Navy.

Each test division receives at least one Y model. The first testing program for these airplanes is called the Performance Evaluation Phase of the BIS Service Acceptance Trials. These performance tests, which must be completed within 60 days, are accelerated under the highest priority in order to size it at early operation so to whether the plane meets the design specifications and whether fleet delivery should commence. (Up to this time no aircraft have been delivered to the Navy other than the Y model.)

At a subcommittee at BuAer, the contractor BIS, the fleet test division, and an other interested contractor meet to decide on five questions before

## Sea Duty

fleet delivery. When this conference is completed, the contractor must promise the changes in his production line speed upon and modification of plans ready for fleet delivery.

### Squadron Introduction

While testing of the Y model airplanes continues, another program commences at Patuxent in solving the Service Test Division. This is called the Fleet Introduction Program, the object of which is to turn pilots and ground crews of the first Midland and Amphibious squadrons who are to operate the new airplane (NAV February 28, 1955, p. 22).

Upon arrival at Patuxent the 12 pilots and 60 ground crewmen scheduled, in one type of maximum compressed of their squadron. The program results in approximately 700 flight hours on its solo, instructor, production planes. Excellent jobs, wing data and ground support personnel, from contractor mechanics to ground crew, the squadron maintenance personnel, besides the flight personnel, ground the pilots. After the introduction program, the fleet is ready to commence operating the airplane.

The Fleet Introduction Program at Patuxent is now commencing with the regular BIS trials. Service Test Division test series will be extensive acceptance trials.

The Maintenance Department of Service Test watches for difficult accessability to internal hardware, evidence of design shortcomings in the aircraft, poor operation of hydraulic and pneumatic equipment, difficulties in engine removal and the like. The maintenance men also watch availability of air speed tools, handling equipment, or during tests.

All actions are given through ground checks. After the acceptance check, Service Test pilots commence



PATUXENT ANSWERS: If it's the SAID, the F4D-1N or the F4D-1R fly with the fleet.

NAVY INSURANCE must be conducted for structural integrity in carrier operations. Here an F4D-1 is fired from a stress catapult.



## Systems Engineering at The Ramo-Wooldridge Corporation

HQM and IFM are prime examples. ■ The International Ballistic Missile and the Intermediate Range Ballistic Missile, Air Force programs for which we have over all systems engineering and technical direction responsibility, are prime examples of programs that require the systems engineering approach. Most Ramo-Wooldridge work is of such a systems character, requiring the concerted solution of a wide variety of interrelated technical and operational problems. Additional examples are: ■ Weapons development, test-control, and computer programs for the military, and communications and operations research projects for business and industry.

Permanent Technical Staff ■ Successful execution of systems engineering programs requires that the technical staff include experts in a considerable number of scientific and engineering specialties. At Ramo-Wooldridge, some of the permanent fields are aerodynamics, propulsion, digital computers, information theory, radio propagation, radar, infrared, or communications, geophysics, and nuclear physics.

The kind of team required ■ A qualified systems engineering staff must include members capable of theoretical and analysis who can predict the behavior of complex systems, as well as experienced experimental physicists who can develop suitable new techniques for measuring actual physical parameters. In addition, the team must include experienced apparatus and equipment development engineers, to ensure a high level of proficiency in the building and production.

Security and industrial aids are important in systems development work, so we have developed an elaborate industrial data aid as a broad answer to the question: how can we make our systems and aids available to the military and industry at The Ramo-Wooldridge Corporation?

System Missile Research and Development ■ Industrial Test and Data Processing  
Air Operations and Program Test Systems ■ Digital Computers and Control Systems  
Communications Systems ■ Missile Guidance and Control Systems

## The Ramo-Wooldridge Corporation

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### Runs Navy Air Testing

Rear Admiral Clifford H. Dunfield has been commander of NATC since March, 1954. A graduate of the Naval Academy and an aviator since 1919, he has served in commanding offices of the aircraft carrier *York*, and *Ticonderoga*. His administrative duty includes tours in the office of the Deputy Chief of Naval Operations (A-6) and as Assistant Director of the Aviation Plans Division. He was captain of the fast Navy war ship *Independence* (BB-39) until 1946.

around the clock, flying to determine the tactical suitability, of weather suitability, and the operational safety and reliability of the airplane.

In evaluating tactical suitability, the new plane's performance, maneuverability and fighting ability are compared with other fast Navy fighters when it comes-on the air. Test pilots observe in flying the new plane alongside another to learn the weaknesses and advantages of the new plane. If possible a new fighter is flown against the U.S. Air Force's F-105.

First, engines checked of the new plane in tests under simulated combat conditions. All engine equipment is checked under tests to ensure that the vibration is satisfactory in combat conditions. Temperature tests and the checks of heat resistance per second to handle the engine equipment as important aspects of the plane's tactical suitability.

### High Speed Check

High speed characteristics are investigated exhaustively. Service Test wants to know whether the plane can out maneuver enemy fighters in combat situations, in a tail chase. With an engine on its tail will the performance characteristics give Navy pilots the chance to regain the initiative?

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Now—another record for the G-E J47...

# 1700 HOURS ALLOWABLE OPERATING TIME BETWEEN OVERHAULS

New 300-hour increase for Boeing B-47's J47-GE-25 powerplant helps

Strategic Air Command increase flight efficiency still further



TODAY POWERING OVER 75% OF SAC'S MT. SOMERS, the J47's allowable time between overhauls has increased to 34

times original 1948 figure. General Electric engines helped make that possible through 20,000 design improvements

Today—1700 hours between overhauls for General Electric's J47 GE-25 jet engine. Installed in over 1300 SAC B-47's, the G-E J47 now has an "allowable" greater than any other known subsonic jet engine in operation.

To the Strategic Air Command, now celebrating its tenth anniversary, each extra hour allowed B-47 engines can mean up to 500 air miles. G-E's recent 300-hour increase means 150,000 more miles (300 X plane's average speed of 500 mph) of efficient operation for the Boeing aircraft—as many as 12 more long-range missions before the engines must be pulled.

And performance records of General Electric's J47 continue to grow. The engine flies 5,500,000 miles every day in Air Force fighters and bombers. Since 1948, the J47 has logged 10,000,000 hours in the air—has flown 5 1/4 billion miles.

The J47's record is one more example of G-E aviation achievements. But at G-E, the goal stimulates more progress. When the J79 turbojet—G-E's recent and most powerful—joins Air Force and Navy squadrons, it too will make a tremendous G-E contribution to U.S. aviation. General Electric Company, Cincinnati 15, Ohio.

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1935 P-51 Mustang—Model P-51B



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Three long winning tests have shown Gulf oil's superior advantages.

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to operate from aircraft carriers is essential.

For the BHS Stability and Control Tests, Flight Test uses a completely instrumented airplane. Prior to every running actual test work, the air speed and altitude position errors are determined specially by the conventional dynamic response method. Typical flying qualities determined at forward and at stall at gross weights positive and at stall gross weights critical for the characteristics under test.

- Dynamic longitudinal stability
- Minimum longitudinal stability
- Elevated control effectiveness
- Longitudinal trim changes
- Static lateral-directional stability
- Lateral and directional trimability
- Stability and control characteristics in power approach, landing and take-off
- Mach number effects on stability and control characteristics
- Stability of artificial feel in power controlled systems

For the BHS Aircraft and Engine Performance Tests the airplane's weight, weight, instrumentation and static thrust are checked prior to flight. These tests produce data on:

- Stall speeds in various maneuvers obtained in power approach
- Take-off performance including zero time take-off run and take-off speed obtained from photographic data
- Gross thrust available and required over a range of gross weights and altitudes to give a performance curve. Types that  $V_{max}$  is altitude curves are determined
- Check performance such as turn rates time to correct cooling and heat check schedule. Thus, Flight Test pilots obtain specific data to judge whether or not the airplane meets the contract guarantee.

The BHS Carrier Suitability Trials are divided into the catapult launching, arrested landing, carrier arresting and carrier qualifications phases. Prior to flight, critical static measurement of airplane gross weight, horizontal and vertical control surfaces positive and critical clearance are made. Catapult and arrested landing phases start at maximum gross weight and speed gradually reach maximum guaranteed weights speeds and load factors.

- These tests determine:
- Suitability of airplane catapulting and arresting equipment
- Dynamic and aerodynamic characteristics of the airplane after being catapulted and arrested
- Structural integrity after maximum load factor catapult and arrested landing tests

The carrier arresting phase actually determines that the airplane has the correct geometry and clearance for

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If vibration is creating fastening problems in your equipment you need CamLoc 1/4-turn fasteners... because the unique design of these fasteners makes them absolutely vibration-proof! CamLoc 1/4-turn fasteners are only half the cost of other fasteners. And you save with CamLoc, too, because they are so easy to install, saving precious time and labor, and lower inventory are required for any given job.

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# Missile Guidance by Reeves

IN U.S. NAVY'S FIRST GUIDED MISSILE SHIP

USS BOSTON, first of the U.S. Navy's guided missile cruisers, highlights unique technical advances in the continuing program of guidance system development in progress at Reeves in the U.S. Navy Bureau of Ordnance.

Equipment installed on the USS BOSTON, test of successful experience with previous Reeves installations on USS MISSISSIPPI and USS DECATUR (DDG-921), permits a new high degree of autonomous program control of the ship to its missile flight path right up to the moment of impact.

Reeves work with the U.S. Navy and U.S. Air Force goes back to the earliest days of their successful missile guidance programs. If you are concerned with the placing of guns or sub warheads in the field, at remote or aerial guidance, under guidance control, under mechanical or computer systems of any type, you should investigate Reeves' capabilities and thoroughly examine our research, engineering and manufacturing facilities.



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REEVES COMMAND GUIDANCE SYSTEMS  
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A Subsidiary of Dynalco Corporation of America  
215 East 57th St., New York 22, N. Y.

known assets. If Bo's data, which burner engagements are made. The burner engagements phase initiates the stability of the new system to be taken to use for its actual burner test.

The B15 Automatic Test for lightness and burner down new tests of automatic flight control equipment, for control systems, fixed gas gyroscopes and chemical devices and sensors.

Automatic Test removes one Y would be B15 test. Ground test check.

• Fine of removal and replacement of guns.

• Fine of loading, clearing guns and emptying ones of fuel gas.

• Effects of gas flow on fire control equipment, other automatic equipment and engine operation.

• Automatic base legs to release air cars of launch and rocket systems.

• Safety features for loading and unloading of stores.

• Interchangeability of automatic equipment such as launch racks, rocket launchers and gun packages.

• Adequacy of storage, loading and unloading of chemical stores.

• Adequacy, reliability, and general functioning of guided missile vehicle bays.

The program then is made for operation of all automatic systems in the air. For the automatic flight control phase, the structural and functional suitability of the equipment is determined after separation of both positive and negative flight performance requirements, of those expected in combat.

The ability of the equipment to control the engine automatically through a control system is maintained.

Gun Accuracy

Flight tests to evaluate fixed guns determine the accuracy, accuracy and reliability of the gun mechanism through attempted 100% accuracy from sea level to within 2,000 feet of the vehicle ceiling. Particular emphasis is paid to air gun effects on aircraft availability and on engine operation. Discrepancies such as missile launch at night and loss of accuracy, gun gun construction and damage from direct hit are carefully observed.

If applicable, in addition to checking the accuracy, accuracy and reliability of determining chemical stores-related problems such as the extent of combustion system of isolated compartments is checked during deployment are carefully examined.

The guided missile guidance system that the missile fit can be carried and fired from the airplane properly. The data habits and reliability of the airplane as a guided missile platform, an auto-stored missile, standard combat readiness.

Through all of this flying, Automatic Test pilots compare the results observed with the new against both older

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RADAN Systems are the most accurate airborne navigation systems an air line can buy. They are completely self-contained—need neither ground aids nor celestial fixes. They will work anywhere in the world, under any conceivable conditions.

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RADAN Navigation Systems are typical of the many notable components, equipments and systems that have resulted from GPL's advanced technological resources and engineering skills.

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types and Navy standards. An Avionics Test House transforms photographic and cartographic data into a measured measure of the free world's various performance.

Electronics Test is the organization at Pensacola to assure that the ever growing number of black boxes in airplanes are manufactured properly, operate according to specifications and function correctly in the airplane. The basic objective is to provide evidence of reliable hardware for the formation of quality, not at any time and proper functioning of safety events. Repetitive testing of the test, done.

• Communication equipment is tested at various altitudes and the maximum reliable range for station service is determined.

• IFF equipment is flight tested for accurate patterns and range performance.

• Maximum ranges for various types and uses of targets and drop-out of target at altitudes are determined for radar.

• Electronic navigational equipment of all types is tested, such as heading equipment, Loran, radio beacon, magnetic compass, inertial navigation, Taurus, and direction finding.

• Electronic countermeasures (ECM) equipment is checked to assure its accuracy, design, operation and that it is electronically accurate.

• Performance of Airborne Magnetic Detection (AMD) wireless receiver and airborne radar equipment is as varied, a process involved over several thousand targets and the results compared with that from other airplane configurations.

• Automatic loss in the airplane at all crew stations is measured to decide the failure situation of the same level is acceptable.

Electronics Test's evaluation for the electronic equipment phase of the IIS trial is designed to determine the actual voltage power requirement of the airplane. The operating equipment must be able to supply this requirement under actual operating conditions, with out exceeding recommended ratings.

**Other Testing**

315 Tests include approximately 44% of the flight hours and efforts at Pensacola. The remainder of the tests, comprising testing new engine developments, experimental instruments, modified engine parts, and low cost test systems, require of electronics equipment and similar do disassembly testing reported by Baker. A Test Pilot Training Division also includes the Test Center considerably. Whatever the project, Pensacola pilots bring their test flights have one objective. That is to improve the planes delivered to the fleet.

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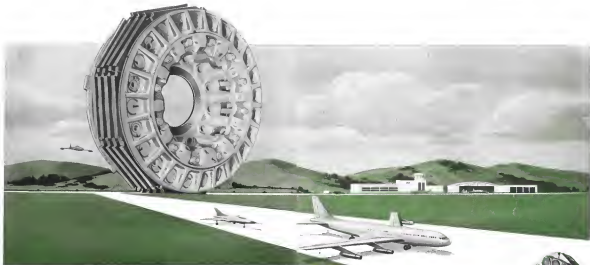
Typical applications are for left engine exhaust, exhaust control, heated pipes, and propeller heaters. Many more include heating and drying units in aircraft and a variety of heating elements for ships, cars, trucks, tanks, buses and dryers in industry.

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## **Bendix** BRAKES WITH

Here is an unbeatable combination—the Bendix Segmented Brake and Cerametalix<sup>®</sup> brake lining.

These two were made for each other—efficiently! For Cerametalix was developed by Bendix for Bendix' brakes; then, the brake itself was proportioned to take full advantage of this new kind of lining.

**NO FUSE.** The result is a brake that will not fade, fuse or lose friction, even when the linings run red hot.

**LESS MAINTENANCE.** Adjustments are less frequent and linings last several times longer.

**NO HEAVY.** Cerametalix is a good conductor of heat. This, combined with the exclusive Bendix segmented rotor, eliminates warping and welding of friction surfaces.

## **CERAMETALIX**

It all adds up to a new high in brake performance—a brake that can be depended upon under the toughest conditions from touch-down to the end of the landing run!

Bendix brake rotor faced with Cerametalix—an entirely different kind of friction material that has amazing resistance to heat and wear. As a result, friction loading and energy absorption can be approximately doubled.

\*Based on test data.

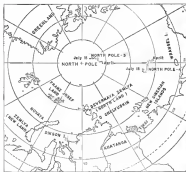


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Export Sales: Bendix International Division, 305 E. 42nd St., New York 17, N. Y.



SMALL AIRBORNE RULLDOZER is used to move cargo off-loaded from R-12 "Cuckoo" in Soviet outfit to use the base North Pole 3 and North Pole 4. Aircraft provide all logistic support for Soviet expeditions and are used for communication.



IN THE FIRST THREE MONTHS the base drifted 250 miles closer to the pole. In a year NP-3 drifted past the pole and headed into the Greenland Sea, covering 1,400 miles.



THE "GARI" (D-3) is widely used to supply Russian polar expeditions.



LEADERS plan geographical studies.

AVIATION WEEK, May 21, 1956



PORTABLE combustion heater is used to heat R-12 for starting.



SI-60 0055 and "Blond" helicopters are used for short-haul work.

## Air Support Vital in Red Polar Operations

Nearly two years of arctic polar expedition experience are behind the Soviet arctic expedition for the International Geophysical Year. Two permanent drifting ice base, established near the North Pole in April 1954, apparently were in operation throughout 1955. The bases, called North Pole 3 and North Pole 4, were completely dependent upon airdrop supplies. Expedition bases were largely icebound. The bases were

both because of arctic winds by the discovery in 1945 of the endowments "Lomonosov Ridge" extending from the New Siberian Islands to Greenland and Ellesmere Island.

Russia is also annually using aircraft to supply a number of towns that have normally been established along the northern coast of Siberia and for arctic reconnaissance along Russia's northern sea coasts.



THE LAZ-45 LIGHT TRUCK is the Russian equivalent of the jeep and can be loaded by the "Himal" helicopters.

AVIATION WEEK, May 21, 1956

## Airborne Weight, Strength Study Recommended by Engineers

By Irving Stone

San Diego—A recommendation that the Department of Defense make a study to determine the dollar value of establishing minimum weights in airborne components was made at the 19th Annual National Conference of the Society of Aeronautical Weight Engineers.

C. E. Burr, Northrop Aircraft's Engineering Weight Section assistant supervisor, told the 125 engineers attending the conference that more of the data to be realized in such a project is available to the Department of Defense than to individual contractors.

Burr suggested that operations analysis engineers at various companies gather enough data on some aircraft and components to permit a preliminary weight cost study, such as was made at Northrop on the Scorpion B-99D. The Northrop study showed how the value of saving a pound of weight varied between four and ten times the cost of manufacturing an airplane pound.

Discussing Boeing airplane C-17 external component studies, D. D. Cox, weight cost chief of the company's So-

uth Division, said titanium alloy or aluminum alloy construction or a sandwich form is superior to steel in a strength/weight basis at elevated temperature up to 500° F. for long periods of exposure. Because of that he said, Boeing believes the long-range superiority result of the future should be built of titanium alloys.

### Titanium Competitive

Boeing studies also have shown that titanium alloys are competitive, on a strength/weight basis, with aluminum alloys for certain primary structural applications on present day aircraft design.

For the thin wings required for super sonic flight, Cox said aluminum can structure must offer considerable weight advantage over conventional aluminum wing construction. This is because the bulk of the material is located near the surface of the wing, giving a greater bone depth and resistance.

Another advantage of the unshrinkable material is that it provides greater residual rigidity per pound of weight. This is important with thin wings where flutter may be a serious problem.

### Design, Test, Redesign

"One of engineering's most important roles in aircraft development is in convincing people who are not in engineering that we do not have sufficient knowledge, that we must design, construct and test, and then redesign, reconstruct and extend as several cycles, then finally flight test the article," Dr. W. F. Ballhaus, Northrop chief engineer, told the weight engineers.

"We must expect failure in the process, but must always define the problems clearly, recognize and solve them, so that ultimate capabilities of the system can be realized."

Cox said the higher thrust engines used for supersonic flight aggravate the problem by causing more noise pressure in aircraft structure. This can greatly influence the location of engines. Also, weight may have to be added to structure to withstand additional noise pressure.

### Closer Cooperation

R. E. Knight, Goodyear Aircraft Corp. assistant, said closer cooperation between the weight engineer and the aerodynamicist, Knight said, is

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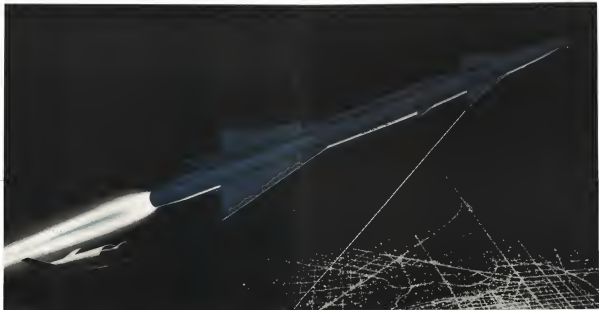
## Saginaw <sup>b/b</sup> bearing Screw

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XB-47D Testing T49 Engines

Two Boeing XB-47D Stratojets are combining the flight test program of Convair Wright T49 turbojet engines. The T49s are installed forward, each replacing two General Electric J47 turbojets. Outboard J47s are in place. Refueling receptacle is open on this XB-47D indicating that tests have been conducted using refueling technology.



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WIDTH	0.500" MAX	MAX PER LOT LENGTH	100"
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increase of 10% in the gross weight of an airplane is an airplane type certificate weighing approximately 10,000 lb. normally approximately in a 17% longer takeoff run a 15% decrease in its level rate of climb, and a 5% reduction in absolute ceiling.

The same 10% weight increase, providing fuel load is constant, results in a reduction in range of 12%.

#### Altitude Reduction

Referring to a high altitude sounding rocket, Knight pointed out that a 10% increase in structural weight will result in a reduction of about 10% in peak altitude attainable. On the other hand, he and that if structural weight were reduced by as much as 50%, enabling propellant content to be increased from 60% to 90% of total rocket weight peak altitude could be increased by about 65%. Adjustment of the actual design condition represents a real challenge to weights and structures engineers working on preliminary design of rocket vehicles, Knight said.

Knight also covered stresses in formulas for the following parameters: horizontal location of C.G.,  $\pm 25^\circ$ , lateral and vertical C.G. positions in  $\pm 10^\circ$  for rocket-borne aircraft, moment of inertia values,  $\pm 10\%$ , inclination of principal axis (product of inertia),  $\pm 1^\circ$  deg.

Weight estimation by weight penalty



#### Test VTOL Engine

First qualification run on a jet control and propulsion system for the Ryan X-45 VTOL aircraft has been completed in the company's new vertical test cell. The unique propellant configuration, including the system for control in the vertical attitude and during transition, was operated for 24 hours: five hours in the horizontal position, 15 hours in the vertical position and five hours in the horizontal position. Control was provided through sensors in the tail pipe or by monitoring the last segment of the tailpipe on power of guidance.

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The more deeply rooted you are in all the things of which systems are composed, the better able you are to resolve completely, dry, soluble systems.

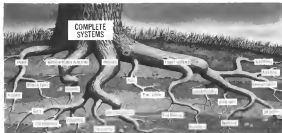
Mendis has an engineering and research staff of over

9,000 with an exceptionally broad range of technical abilities.

Over \$20 million was expended on engineering and research functions in fiscal 1965.

Twenty-four widely dispersed manufacturing divisions located east to west under 30,000.

The Bendix Systems Planning Group at headquarters in Detroit coordinates major systems work and grows out a single, centrally located contact.



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SYSTEMS**

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in every phase of systems work**

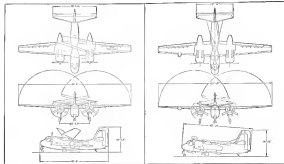
## DISCUSSION • CONCEPTUAL DESIGN

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- PROTOTYPE DESIGN & MANUFACTURE
- ENVIRONMENTAL & OPERATIONAL TESTS
- SYSTEMS PRODUCTION • SUPPORT

## 8. FIELD SERVICE



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QUALITY PERFORMANCE  
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### Sub Hunter Into Transport

Glennau's TF1 ability (sneaky) (left) is a variation of the operational SIF-1 suit battlefilter (right). Maps change with the replacement of the SIF's extensive network weapon system by cyber increased firing rate as maps rule. TF1 also has modified flight-like shape and low fire rate open on the horizontal tail. TF1 have been assigned to Fleet Logistic Air Wings in center swampy marsh, replacing old Glennau TIF dangerous hostile battles.

concept for preliminary design was directed by R. L. Blomquist, Chance Vought Aircraft, Inc. This concept permits a detailed weight analysis of special design features as well as for the basic structure. This approach also allows the evaluation of weight effects of impedance and stiffness requirements, material types and structural arrangements.

Mummit defined basic structural weight as the optimum structural material required to form the actual container and to resist the overall external applied loads, including local loads. This weight is determined by analytical methods.

Weight penalties for special design features such as landing gear, production costs, control surfaces, high lift devices, etc., are determined by empirical methods, Kugler said.

Suggestions for possible weight savings in landing gear strut design were offered by V. N. Fomgov, weights group supervisor with Bendix Aviation Corp.'s Bendix Products Division. Fomgov said external lugs should be grouped to facilitate machining, and slightly additional fork thickness should be allowed, instead of greater width, to obtain better fork sections.

He also pointed out that the referees

builder should place more reliance on a street builder's greater design experience to produce the lightest street configuration.

Use of high speed digital computers to solve wing structural weight problems was outlined by Dr H H Dixon, Douglas Aircraft Co., Santa Monica. This technique, Dixon said, allows a detailed weight analysis of the wing structural box, including the combined effects of shear and bending occurring in multiple loading conditions.

Without the use of high speed digital computers, he said, the scope of this type of investigation would not be feasible.

Used on the DC-3 jet transport design, the computer analysis permitted a rapid evaluation of the stresses, compression lateness structural weight and secondary characteristics of the wing. These and

The need and opportunities for graduate engineers in the field of weight control for the specific duties of weight research and development, weight analysis, and project weight supervision was stressed by G. A. Kelley, Jr., member of the Society.

act weight control engineer, Chester Wright Aircraft, Inc. He emphasized that weight control engineering should be promoted and publicized in the college as a special field.

Convair Dedicates  
Model Towing Basin

**San Diego**—Corvus Division, General Dynamics Corp., recently dedicated a 100-ft model towing basin section of its proposed \$800,000 hydrodynamics laboratory.

The present unit will accommodate models up to 5 ft in span, which can be towed by the electric-powered carriage at speeds up to 100 ft/sec.

When completed, the facility will have 700 ft. of towing basin with a 100 ft. by 100 ft. turning section in the center where artificial waves and wind sea conditions can be created.

## Stainless Use to Grow In Supersonic Aircraft

At least 50% of future supersonic aircraft and engines will be fabricated of stainless steel, Republic Steel Corp. predicts. To meet increasing demands for the metal, the company recently increased its capacity 18%. Last year



## Fibermold Quenches Fuel-Thirsty Planes for FLIGHT REFUELING, INC.

Fibermold quenches high-velocity aircraft fuel during refueling. This is of great importance in fueling military jets. Flight Refueling, Inc., The Dayton, Ohio, unit of a branch of hose making from the rubber industry, the flight of the hose, and at 2000 psi, the hose provides a suitable target for the flight of the fuel during refueling. Fibermold is used to make this contribution in the aviation of high speed and power.



Fibermold quenches high-velocity aircraft fuel during refueling. This is of great importance in fueling military jets. Flight Refueling, Inc., The Dayton, Ohio, unit of a branch of hose making from the rubber industry, the flight of the hose, and at 2000 psi, the hose provides a suitable target for the flight of the fuel during refueling. Fibermold is used to make this contribution in the aviation of high speed and power.

Send for literature. Below the figure complete digest of Fibermold hose systems, equipment and features.

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it manufactured 22,379 tons of the metal. It estimates that it supplies 20% of the market.

To handle adequately the large quantities of aluminum, the firm has installed a new 100-ton rolling mill containing 17% chromium and 7% nickel. For jet engine applications, Type 410 is used in 500 deg., Type 424 in Type 347 to 5,400 deg., Alloy 1-400 deg., Type 180 is recommended.

## Portland Copper to Build GE Assemblies

Wetmore and Bannister, manufacturers for the General Electric (GE) will be built by Portland Copper & Tank Works, Inc., South Portland, Me., which did development work. Production contract totals \$1 million.



## F-102A Bulkhead, Wing Spar Forgings Assembled

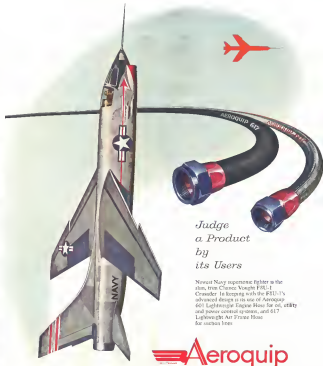
Backlog bulkheads (above) and wing spars (right) for F-102A aircraft are being assembled in two large, cold-chambered forgings at General Dynamics Corp., a total of eight parts for the delta-wing F-102A, supersonic interceptor are made from heavy press forgings manufactured by the Wagon-Gordon Co. and the Aluminum Co. of America. Early F-102As and later models will have heavy press forgings available. These giant forgings reportedly are 275 parts and 9,000 parts and more than 100 pounds of weight in the F-102A. General plans to use 15 heavy press forgings in the new, four-engine version of the F-102A, the F-102B.



## Lockheed Develops Test For F-104 Tail Surfaces

A cheap, opto-geometric method of measuring curved surface response has been developed by Lockheed for checking the F-104A tail surfaces without expensive test sets.

The method consists of placing a large mirror outside the hangar door in a position to reflect sunlight onto a small mirror attached to the wing tail. Movement of the light spot reflected from the small mirror to the hangar wall can be measured and translated to show the angular deflection of the surface. At the distance later the wall used in Lockheed's tests, a deflection of one degree will move the light spot 15 inches. Deflections as small as three minutes of arc can be measured.



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## Supermarine N.113 Carrier Trials

Victory Supermarine N.113 jet fighter, designed to carry on close back, is about to touch down on the carrier HMS Ark Royal (above) on its initial carrier trials. Powered by two Rolls-Royce Dart engines, the British Navy fighter is about to engage another jet (below right). Engines are run up (right) while Supermarine is on the Ark Royal's main catapult. Trials were completed successfully. Prior to the carrier qualification trials, the aircraft was tested at the Royal Aircraft Establishment. Its carrier use was initially tested (lower below). The aircraft with its back lowered was tested at increasing speeds into the carrier waves. Deceleration was recorded and stress gauges measuring the forces to which the aircraft was subjected.



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- + Chemically inert to synthetic lubricants, hydraulic fluids.
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- + Size 1/2" to 1 1/2", with or without standard fittings.

# Titeflex

## Predictions for Record Electronics Sales Upheld by Financial Reports

By Philip J. Klass

Manufacturing sales and profits reported by a number of avionics-electronics manufacturers in 1955 and first-quarter 1956 figures lend support to the predictions by officials of Radio Corporation of America and Hoffman Electronics Corp. that their sales will double in the next five to 10 years, for example.

Hoffman Electronics Corp. reported first quarter profits up 51% from last year.

Servo Corporation of America reported 1955 profits before taxes up 69%.

American Bosch Arms Corp. first quarter sales and profits rose 24% and 5%, respectively, above last year's last three months.

Radio Corporation of America showed 7% first quarter gain with a modest increase in profits.

### Hoffman Electronics

Hoffman, which is producing airborne Tacan sets and test equipment, and ANP-51 airborne range-only radar, reported its first quarter sales reached \$12,355,019, 35% over 1955's first quarter. Net profit after Federal taxes was \$467,994, or 46 cents per share on 728,842 shares outstanding. This is a 53% increase over 1955's first quarter.

Company backlog is approximately \$15 million, a figure expected to increase substantially in the next few months, according to H. L. Hoffman, president. Future military backlog, covering 11 major production contracts and 22 research and development projects, represents 18-month productivity at present levels.

The firm, which also is active in developing weather reconnaissance and the production of single channel content for the Military Service reported that some of its most recent engineering development work involves the transmission of signals to and from outer space. Although this work is highly classified, the firm is working on projects which compare communications through the ionosphere and ionospheric as well as in satellite projects such as Vanguard.

Hoffman also is working on an airborne radar, the ALA-6, which enables

its search ECM operator "to determine the direction of intercepted radio or radar signals." The system provides a visual indication on a cathode ray tube of the relative bearing of the radiating source. The company said it holds five R&D nonexclusive contracts.

The firm also noted that it is developing a "pulse-dropper, moving target radar for guided missile search and track applications. Modification of the pulse-dropper radar made it possible for the operator to distinguish between an individual, a group of people, as well as moving vehicles. This new radar development offers a wide variety of potential applications in area surveillance for commercial as well as military applications."

### Infrared Department

In the field of missile guidance, the company said it is working on projects involving the branching, intermediate, and terminal guidance phases. It recently established a new infrared division in its engineering department.

Pointing out that Hoffman has had a 1,200 percent increase in sales during the last decade, the firm's president said it hopes to double its present volume in the next five years.

The shorter production runs and greater complexity of military equipment indicate that "his company which



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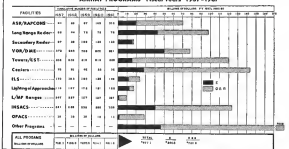
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### AIRWAY PROGRAMS Fiscal Years 1957-1961



FEDERAL AIRWAYS PROGRAM of nearly \$8 billion for the next five years includes \$246.2 million for equipment and establishments \$710.9 million for operation and regulation. Approximately \$60 million is to be spent on 75 long-range and 162 secondary radar installations.



As flight systems have become more complex, speeds higher, space and weight-saving more valuable, the increasing rate of technical progress in the aircraft industry has created a serious problem:

Keeping its products up to top level of operational effectiveness—and in the air—has become a major responsibility of the prime contractor.

Martin has been working on that problem for many

years; and the result is a new kind of service organization and systems method which now provides for the maintenance of all Martin products—from the company's assembly lines to operational flight lines everywhere in the world—at peak efficiencies and with maximum availability.

It is service on a systems basis, and already it's setting a new pace in the industry.

**MARTIN**

helps to maintain the same volume as 1957 will add them, since the engineering complement that was acquired in 1950," Hoffman said.

In recognition of this trend, the company plans to construct a new six-story building to provide enough space "to keep our engineering force within the next 15 months."

#### Steris Corp.

Steris Corporation of Allentown, last Case designer and manufacturer of semi-enclosed communication and navigation instruments and systems reported 1955 sales of \$4,134,000, an increase of 18% over 1954. Net profit before taxes, \$552,560, was up 66% over 1954. Net earnings per share, based on 494,781 outstanding, were 55 cents, up 53% from 1954 and up 55% from 1953.

At the close of 1955 Steris's current assets were \$2.6 million, up 100% of 70% over 1954. Working capital totaled \$1.4 million, a 48% increase.

#### American Bosch Arms

Supporting back quickly from the effects of its recent strike, American Bosch Arms Corp. reported first quarter sales of \$23,707,46, up 26% from 1954's last three months. This, coupled with special line credits to the amount of \$214,079 produced a net income, after taxes of \$3,899,960, up 27% from 1954.

Earnings per share, on 1,740,017 outstanding, amounted to 33 cents, up 26% from last year. The company declared a 25 cent dividend on April 17.

For the full year of 1955, the firm reported its profits reached \$3,183,560, an increase of 37% over 1954 despite a 1% drop in gross sales which ran \$73,885,925.

The company, which holds similar production contracts for the MID-9 firm control system used to defend the B-52, and is active in the terminal guidance field, received a \$25-million boost in backlog during the first quarter of 1955 for a total of \$185 million. This compared to an \$80 million backlog at the start of 1955.

#### ECA

ECA Corporation of Ansonia, which last year posted the 18 U.S. companies that gross more than a billion dollars annually, reported first quarter sales of \$27,545,600, a 17% increase over 1954's first three months. Profits were \$2,397,880 before taxes, \$12,727,000 after taxes, roughly 1% above the same 1955 quarter. Earnings per common share for the first quarter were 85 cents, versus 94 cents for last year.

ECA projected its 1956 deliveries to the Government will run close to \$250 million. The company and its backlog

of Government orders on April 1 ran \$265 million.

Chairman of the Board Elford Sorell predicted the electronics industry will double its present \$11 billion business by the end of the next decade and RCA's business will exceed \$2 billion.

#### Consolidated Electrodynamics

A West Coast instrument manufacturer, Consolidated Electrodynamics Corp. showed a 1955 increase in sales over 1954 with a year end total of \$47,124,423. Net earnings after taxes were \$561,696, approximately 5% below 1954, while per share earnings were 57 cents, approximately 10% under last year's figure. The company has \$43,520 shares outstanding, an increase of approximately 6% over the previous year.

Lower earnings were attributed to higher research and engineering costs and increased competition. However, net earnings for the last six months of the year were 54 cents per share, the highest for any six-month period.

#### Thomas A. Edison

An East Coast aircraft instrument firm maker, Thomas A. Edison, Inc., reported first quarter sales of \$9,899,446, an increase of 13% over last year's first quarter. Profits after taxes were \$382,873, up 19% over last year. Per share earnings were 73 cents on 504,164

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These special lubrication methods are guided by temperatures involved in the motor's final application. For example, a special lubricant is just the right amount used in bearings where the motor will have to work at 145 F. At this temperature ordinary lubricants tend to thin and break down. G-E aircraft motor bearings are specially lubricated for flight temperatures, too. At lower temperature lubricants tend to stiffen, and too much lubricant in the bearing could prevent the motor from starting.

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**GENERAL  ELECTRIC**



USS SARATOGA, (CVRA 60), Navy's most powerful aircraft carrier, has more than four acres of flight deck, two acres of hangar and

## Saratoga Has Novel UHF "Gun Tubs"

Recently commissioned 68,000-ton USS Saratoga carries the Navy's newest wireless equipment, including Tacan and a novel UHF radio antenna array.

To meet antiaircraft defense requirements, and provide full 360 degree UHF radio communications coverage to aircraft and other ships, the Saratoga's antenna arrays carry in "gun tube" of each corner of flight deck (see below).

The Tacan antenna (below, right), which transmits bearing and distance information to all aircraft within a 200 mile radius, can stop the Saratoga's solid mast. Underside of four radio masts carrying intercom, fire-control, and light-bulbs.

Tacan and UHF equipment were designed by Federal Telecommunications Laboratory.



UHF radio antennas, located at each corner of the deck, give 360 degree coverage.

NAVIGATION WEEK, May 21, 1958



TACAN ANTENNA, crumpling as all down, provides stop a burst of surveillance, fire control, and light-bulbs radio antennas, and intercoms all perpendicular.



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Type	Input	Rated Output	Max. Efficiency	Weight	Dimensions	Notes
120-20	120 V	20 W	85	1.5	1.5 x 1.5 x 1.5	120-20
120-50	120 V	50 W	85	2.5	2.5 x 2.5 x 2.5	120-50
120-100	120 V	100 W	85	4.0	4.0 x 4.0 x 4.0	120-100
120-200	120 V	200 W	85	8.0	8.0 x 8.0 x 8.0	120-200
120-500	120 V	500 W	85	20.0	20.0 x 20.0 x 20.0	120-500
120-1000	120 V	1000 W	85	40.0	40.0 x 40.0 x 40.0	120-1000
120-2000	120 V	2000 W	85	80.0	80.0 x 80.0 x 80.0	120-2000
120-5000	120 V	5000 W	85	200.0	200.0 x 200.0 x 200.0	120-5000

Maximum output power depends on ambient temperature. Type ratings are for 40°C ambient temperature. For other ambient temperatures, derate output power accordingly. For full details, write now to our divisions.



## Expansions, Changes In Avionics Industry

Sperry Gyroscope Co. will open a new West Coast engineering facility at Sunnyvale, Calif., in the fast growing avionics community near Stanford University to work in the fields of missile systems, fire control, radar and radio navigation. The move follows recent announcement of company plans to build an engineering and flight test facility at Florence, Ariz. (AV Jan. 3, p. 38).

The Sperry Sunnyvale Development Center will be headed by E. B. Hammond, formerly engineering department head for airborne weapon systems. A small nucleus of Sperry engineers will be transferred from the firm's Lake Success, N. Y., headquarters, but the company undoubtedly hopes to build up its staff from West Coast sources.

Other recently announced expansions:

• **Leitz, Inc.**, has established two operating companies in Europe. One, a Swiss subsidiary, Leitz S.A., has set up offices, laboratories and shops of Cytostar Aeroport, Geneva. The other, a German subsidiary named Leitz Elektronische GmbH, has been set up at Bonn, near Munich. Wilfried P. Leitz, board chairman, moved his residence to Geneva last fall to expedite the European expansion and to look into the possible use of European designs and techniques.

• **Minneapolis-Honeywell** is expanding operations at its Tuxedo, N.Y., plant and moving the group to the Buzza area from its present Minneapolis location. New facilities will include engineering, production, and sales, as well as a new applied research section.

• **Topp Industries, Inc.**, Los Angeles, and Heller, Raymond & Brown, Inc., State College, Pa., will merge. Topp produces airborne instrumentation and/or data computers, while Heller, Raymond & Brown specializes in altimeters and radar altitude indicating systems. Total combined assets will be about \$2.7 million.

• **Sylvania Electric Products, Inc.**, has moved a new Applied Research Laboratory as part of its Western Division Laboratories to work in military electronics.

• **Remington, Inc.**, transistor manufacturers, has moved from New York to a new 100,000-sq-ft facility in Manchester, N. H. The firm said it plans to expand its electronics and electro-mechanical activities.

• **Radio Corporation of America** has moved a new construction group to handle all spare parts sales to the mil-

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Electronics Division, Dept. AV-521

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tion services, defense communications, and often using its military equipment. The work previously had been handled by a subsidiary, RCA Departmental Market Division, the new RCA Defense Space Marketing activity.

• G. S. Marshall Co., electronic maintenance representatives, is building new 7,500 sq ft office at 2065 Huntington Drive, San Marino, Calif.

• Baird Associates, Inc., and Atomic Instrument Co., both of Cambridge, Mass., will merge, providing stockholders approve. Baird is in the field of optoelectronic equipment, while Atomic makes nuclear and electronic instrumentation.

• Harris-Schold Co., Cleveland, one of nation's major printing equipment makers, has purchased Anthony Research, Inc., Bethesda, Md., a firm active in the electronic equipment field.

• Link Aviation, Inc., Binghamton, N. Y., a subsidiary of General Precision Equipment Corp., purchased a controlling interest in Air Transco, Ltd., Ashburton, England.

• Radio Corporation of America will open a new basic development lab at Nashua, Mass., in a 28,000 sq ft building in the New England Industrial Center.



► Digital Missile Guidance—Borroughs Corporation reveals that it is developing and producing prototypes of a digital computer which will be used for guidance of advanced missiles. Borroughs says that computer guidance systems will be transferred to a missile through a radio communications system. New computers will employ transistor and magnetic cores.

► Importance of Name—Aurora Instruments Lab., which has introduced a new automatic non-destructive indicator, points out that a degradation of only 1 db in a radar system's noise figure is the equivalent in performance to doubling and regaining from a five megawatt transmitter or raising 10 to 50 pounds of extra equipment in an aircraft solely to make up for lost performance.

► Atomic Issues New Spec—A new specification covering equipment used in testing for surface mount equipment has been issued by Aerosolized Radio, Inc. Prepared by Atomic's Advanced Electronics Engineering Committee, the new spec (No. 494) is available to mem-

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# L

## ELECTRA (1934):

One of the first all-metal passenger planes. Howard Hughes flew one around the world in 1939.



# O

## HUDSON (1938):

First American-made plane to fight in World War II. First plane to capture a submarine.



# C

## LODESTAR (1939):

Fastest pre-war commercial transport. Served during war as troop, cargo and liner carrier.



# K

## VENTURA (1942):

Venture hit-and-run bomber of World War II. Backbone of Navy's Pacific air striking force.



# H

## CONSTELLATION (1943):

First used as high-speed Air Force transport. Now used by airlines all over the world.



# E

## NEPTUNE (1943):

Navy's first land-based patrol plane carries health, intelligence, mines. Also operates from carriers.



# E

## SUPER CONSTELLATION (1952):

Ultra-modern passenger plane. Also used as high altitude radar plane for Air Force and Navy.



# D

## HERCULES (1953):

Assault freighter. Turboprop powered for high speeds, can carry 35-ton payload.

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► **RTCA Radio Meeting**—The Spring Assembly of the Radio Technical Commission for Aeronautics will be held at the Hotel Statler, Boston, June 5-6. Theme: "Future Use of the Airspace."

► **Computer Symposium**—Proceedings of the Second Annual Computer Applications Symposium, sponsored by the American Research Foundation of the Illinois Institute of Technology, are available. The 106-page proceedings, which include two series of discussion which followed each paper, are priced at \$1. For copies, write: American Research Foundation, C&E I, Technology Center, Chicago 16, Ill. The next annual symposium will be Oct. 9-10 in Chicago.

► **Lets of Radar-SCA reports** it has now sold nearly 600, or 500 million worth, of its AN-100 radar warning radar to aircraft and business aircraft operators. Of this number, roughly half have been delivered, and half of those are installed. At the time RCA and Bendix launched their radar development without firm orders, their action was viewed as a calculated gamble. The gamble has paid off for both.

► **Testing Techniques**—Hughes Aircraft will run an electronic technician training program in an effort to ease the shortage. Under the three-year program, which began in June, 68 men will be given four hours per week of electronics, laboratory training, on-the-job classroom instruction, and 16 hours' work of on-the-job training. The men will be paid for a 40-hour week.

► **MIT System Course**—The Massachusetts Institute of Technology offers two summer short-courses of possible interest to the avionics industry.

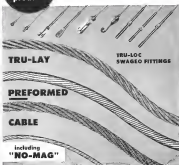
► **"Modern Communications"**, Aug. 28-31 dealing with information theory, coding, error, and detection. A working knowledge of basic information theory techniques and statistical theory is a prerequisite. Visiting lecturers will include Dr. Claude E. Shannon, Bell Telephone Labs and Dr. Bernard Mandelbrot, from the University of Geneva, Switzerland.

► **"Analog-Digital Conversion, Tech. Topics"**, Aug. 13-17, will be devoted toward various and design concepts with a background in electrical engineering but not necessarily experienced in digital data processing.

Full details and application blanks on either course can be obtained by writing MIT's Summer Session Office, Room 7101, Cambridge 38, Mass.

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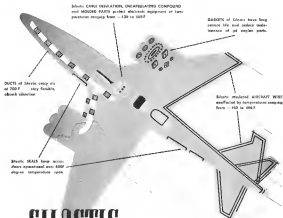


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## NEW AVIONIC PRODUCTS

### Components & Devices

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• **Input scanning network** and 40 amp input will produce full output. Models 2309 and 2310 have push-pull vacuum tube output stages for maximum rated up to 18 and 10 watts, respectively. Bulletin 1206 23011 Rev. 1 gives application data. Servo Corp. of America, 20-10 Junction Turnpike, New Hyde Park, L. I., N. Y.

• **Subminiature tube potentiometer**, Model 150 has soldering type terminals for use with printed wire boards and clip soldering. Pot is removable or adjustable over 25 turns, comes in 11 stand-



ard resistance from 10 to 20,000 ohms with resolutions ranging from 2 to 0.01%. Bulletin 130-6-A gives application data. Summa Laboratories, 6115 Magnolia Ave., Riverside, Calif.

• **Magnetic amplifier relay** has sensitive to 50 to 100 microamperes, operates over temperature range of -150 to 100C, and has 2 amp contact. Seven electronically made MLE-R 575C and MLE-R 5272A. Relay measures 14 on dia x 23 in. long, weighs 6 oz. Bulletin 562 gives application data. The Ligand

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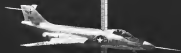
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• **Resistorless recording millivoltmeter,** employs galvanometer recording element with 2 cps undamped natural frequency operating through a novel push-pull arrangement to give resistance



according to 41 in. scale chart paper. Galvanometer gives full deflection for 1 mv. input. Drive rate chosen of 10 chart speeds: 1, 11, 1.6, or 12 in. per minute at per line. Model MA 1677 gives full details. 14 v. dc. power source, 6000 Lumen Air. Edison 9.

• **Vibration calibration,** Model 501 for obtaining vibration pick-ups or measuring vibration of test equipment and the system. In comparison with a primary standard displacement. Servo probe does not require direct contact with vibrating surface, but measures vibration in natural interference of transducer caused by changes in spacing between surface and probe. Device measures over four decade scale ranges from 20 mm/sec. down to 0.02 in./sec. Acceleration, quoted at better than 95% of full scale, independent of frequency over range from 16 to 20,000 cycles. AGC Electronics, 580 North Pine St., Alexandria, Va.



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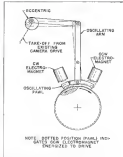
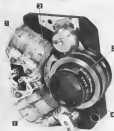
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45 mg (max) / 120 mmHg  
 Complete PR block  
 Second degree 1:2 AV block present.  
 No p waves, but still little p waves.  
 Third degree up  
 80 bpm, 140 mmHg / 100 mmHg  
 Management: 100 mg  
 Give 100 mg up, arrhythmias

## EQUIPMENT



**TWO COILS** (1) responding to a built-in exposure system automatically adjust lens aperture of your camera. A camera meter drives electronic driver in modifying lens (driving), but part (2) is held in neutral. If the light value of scene changes, one coil or the other is energized and part activates diaphragm (log (1) to provide new opening for lens (4). System is a first.

## Gun Camera Tunes Exposure to Light

Sweet, N. Y.—A gas valve which rapidly and automatically adjusts its flow opening to within 1 in. f. step of normal exposure in less than a second in most conditions in order evaluation by the Air Force.

Called KB 5, the gas canister has approximately the same volume as the current standard N<sub>2</sub> gas canister and weighs only 1 lb more when fully loaded. Two KB-5s have been delivered to the Wright Air Development Center.

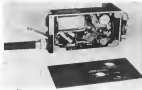
by the maker, Fischel Carvers and Instrument Composites.

As Forno and household officials are confident that the new cameras will allow fighters' points to hang back, a much greater percentage of severely wounded, visible film than is possible with the N-3 camera. The N-3 has only the actings of "bright," "have," or "dull" office has rapid and severely to tape with distinctly changing conditions of fighter combat. One request the com-

can easily be seen at the place of open sky, the rest at a dull, shadowy ground object.

## First Automatic

The KR 5, which is a new design and not a reborn of old ones, is the first gas camera to have that self-contained automatic exposure control, Fairfield officials said. The mechanics can adjust the diaphragm through the seven f-stops from f 2.8 to f 22.



LONGITUDINAL VIEW of camera shows internally-driven sprocket system, and overall length. Lens can be set manually or driven





## Aircraft Controls

chosen to actuate many accessories on new Lockheed 1049G



Across the oceans of the world and over the domestic routes of America, more and more, new Lockheed 1049G Super Constellation are going into service. On these advanced, long range airliners, 34 Barber-Colman electro-mechanical actuators control various valves, scoops, and other accessory equipment.



This is a model of an inlet air diffuser for turbojet engines, mounted in a supersonic wind tunnel. To assure maximum performance, the diffuser must position and maintain the proper shock wave pattern at the engine inlet. This is done by an automatic control which positions the diffuser correctly under all flight conditions. Without this Honeywell control, a supersonic aircraft might never reach design speed.



ONE OF 34 BARBER-COLMAN  
ACTUATORS ON  
SUPER CONSTELLATION

Other Barber-Colman products on the Lockheed 1049G include passenger cabin and flight deck temperature controls, gasoline heater cycling controls, auxiliary warning controls, and electric windshield temperature controls.

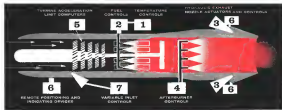
The complete line of Barber-Colman aircraft controls includes: Actuators, Positioning Controls, Temperature Controls, Small Motors, Valves, Ultra Sensitive Relays, Thermo-Sensitive Elements. Consult the Barber-Colman engineering sales office nearest you: Los Angeles; Seattle, Baltimore; New York; Montreal; Melbourne.

**Barber-Colman Company**  
DEPT. E, 1402 ROCK ST., ROCKFORD, ILLINOIS

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OVERSEERS AND OPERATIONS • WELDED PRODUCTS • METAL CUTTING TOOLS • MILLING TOOLS • TEXTILE MACHINERY

# CONTROL SYSTEMS FOR ADVANCED JET ENGINES



With the increasing speed of aircraft it has become more important to integrate power plant controls with the airplane and its mission. For over 30 years Sperry engineers have been actively engaged in developing complete control systems for turbojets, turbojet and ramjet engines. Our Aeronautical Equipment Division will be happy to help solve your engine control problems. Engineers are required in new various exciting programs in engine control development. Write J. W. Gruyer, 199.

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AN ARCADE, SPERRY AERONAUTICAL EQUIPMENT  
OF TORONTO, CANADA, MONTREAL, QUEBEC

## Smaller Size in Cameras

A growing interest by the military in smaller cameras is reflected in two Fairchild projects.

• A film gun camera in the development stage designed to fit in the ultra-thin wings of supersonic fighters. Slightly wider than the 16 mm film camera, it would have a 160-foot film capacity, not the conventional 10.

• A family of 75 mm, precision EVG (image motion compensated) cameras designated CAX-12 and in production for the Navy. The cameras, which take a 15-sec picture up to 10 frames a second at an accelerated 700 ft per second, but give all the performance of the larger units.

is applied through two slip rings at the tail of the block.

The resistance of the material varies with the amount of light striking it as intensity of the light increases, the resistance decreases.

The intensity of the sense light is compared to a reference lamp built into the camera. The reference lamp is a special glow discharge lamp containing neon and traces of other gases. It is operated from a high impedance output to keep it stable.

Since the shutter with the photoconductive material takes at 50 gpa, the light sensitive material alternately

views the light from the picture taking lens and the standard loop 64 times a second.

All light levels are equal, no vignetting are generated. Should the illumination levels differ, current is sent to one of two coils of an electroacoustic amplifier called a wiggler servo, which drives the lens diaphragm in a larger or smaller aperture to match the light level of the standard loop. The loop intensity can be varied to meet exposure requirements of ASA (American Standards Association) 12 to ASA 150.

## Wiggler Drive System

The wiggler diaphragms drive system, developed by Fairchild technicians, is unique in concept.

An arm is attached to a camera motor driven eccentric that one end and to a pivot at the other. The arm is mounted on a pivot between the eccentric and pivot.

As soon as the motor starts, the eccentric begins an oscillating motion to the rear, and thence to the front. At each end of the pivot are the coils and a spring or shock the diaphragm.

When the closed loop exposure coil rolls out, it is in balance—sense light reaches the level of the standard loop—the pivot is held in a neutral position by a lightweight spring. When one coil or the other is compared the pivot end under the coil is lifted up, thence, lowering the pivot. The pivot then sets

## Now!... the NEW ROBINSON WIRE TWISTER with DIAGONAL GRIP - HEAD



Twister, more efficient than ever! The new development DIAGONAL GRIP-HEAD is designed especially for those serious hard-to-get jobs. Built-in spring action safety device. 3 separate gears (not required for use by any other twister) - comes in stock at \$140 per engine assembled.

**3-TOOLS-IN-1** - glass, rubber-tubing, hole-cutting, wire-cutting, and more. Proven, better, better. No adjustment. Just back on wire, cut it off. Perfect, uniform twist every time.

12" - wire assembly has safety wire, 14 in. \$21.90

9" - for tough work, cut \$19.90

Twistmaster, Motor, Rubber, Glass, wire. Just for twisting wire.

**W. C. ROBINSON CO.**  
Box 4718, St. Louis 10, Mo.

Circle 11, Don't miss this, 1958, 1959

## PHOTO-SONICS 70MM-10A RECORDING CAMERA



Up to 60 fps on 16mm film with 400 or 1000 ft magazine. Instantaneous film movement with registration pins below aperture. Translucent high quality 35x45.25 inch picture slates adjustable to 90° movement opening. Removable 16X lens hood for critical lighting and viewing.

**gordon enterprises**

1510 N. Calhoun Blvd.  
N. Hollywood, Calif.  
Circle 12/1958



## Donut Floats for S-35

Rapidly inflated donut type flotation gear (shown above) is being manufactured by Walter Kelle & Co. for Sikorsky S-35 helicopters for emergency water landings in case of engine failure. An compressed 1,800 psi (a 100 psi) nitrogen gas, is electrically released from the pilot through pneumatic lines to each wheel. At the wheel, the compressed air is discharged through driven roller bellows which, through expansion action, cause the compressed air to flow radially out into the base, inflating every latex float. These floats are 51 in. in an average pressure of 11 psi. Special equipment guards against over-inflation and accommodates for temperature extremes. The floats, which permit water landing, provide approximately 1200 lbs buoyancy with a helicopter weight of 1,200 lb. Buoyancy has been CMA-approved. The new pneumatic system weighs less than 15 lb. in 175 lb., with floats.





CONVENTIONAL 60 KVA GENERATOR



NEW STATICALLY EXCITED 60 KVA GENERATOR

Static exciter components mounted within the fanbase of the Lockheed Electra replace the rotating exciter of conventional generators. This design simplification reduces generator output voltage by approximately 130 pounds-per-ampere, saves heating, and improves generator cooling and ability to withstand vibration.



## Why Lockheed Electra Will Use New General

### DESIGN SIMPLIFICATION GIVES RELIABILITY DEMANDED BY TURBINE-POWERED AIRCRAFT

The new *Statically Excited Generator* combines the proven design principles of the conventional General Electric generator with the increased performance potential of static excitation.

Unscheduled delays due to rotating exciter failure or lack of residual magnetism are eliminated. Maintenance cost is reduced because static exciter parts do not need attention between major aircraft overhauls and commutator undercutting and neutral brush setting at time of overhaul are eliminated. Reduced use of the new generator simplifies removal and installation. Also radio interference problems are greatly reduced by elimination of the commutator.

Fire hazard due to energy available for arcing fault after trip is minimized because the static excitation system retains less than one volt a-c while rotating exciter systems have residual of from 50 to 100 volts. Design improvements in the new generator allow higher operating temperatures, permitting use generator to carry the load of two under emergency conditions.

For further information on the new *Statically Excited Generator* contact your nearest G.E. Apparatus Sales representative or write for bulletin GEA 6015, Section 310-100, General Electric Co., Schenectady 5, N. Y.

## Electric Statically Excited A-C Generators

### Fast Response Improves Performance of Electronic Equipment



**APPLICATION OF FULL LOAD**—Normal voltage is reached in .050 second after application of full load. Voltage dip reaches 90 volts—80% of normal voltage.\*



**REMOVAL OF FULL LOAD**—Normal voltage is reached in .050 second after removal of full load. Maximum overshoot is 130 volts—112% of normal voltage.\*



**SHORT CIRCUIT BUILD-UP**—Achieves full short circuit output in .057 second after three phase fault. Steady state current is 360 amps—340% of rated current.\*

\*Performance obtained with a General GE 60 KVA model.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

FROM 35000 RPM AT THE TURBINE  
TO 2400 RPM AT THE WHEELS...



## HYATTS SMOOTH THE FLOW OF POWER IN GM'S EXPERIMENTAL FIREBIRD II

Taming the terrific torque of this gas turbine developed by the GM Research staff is no job for ordinary bearings. Only the finest straight cylindrical roller bearings can stand the gauntlet.

HYATTS easily handle the whirling speeds generated, and at the same time let the turbine shafts float horizontally when they heat up. This "free lateral" feature automatically compensates for shaft expansion without changing the bearing centers. In the reduction gear train, too, HYATTS pass along the power with maximum frictionless losses and maximum resistance to the punishing stress and strain.

So if you've got a tough gas turbine bearing problem, come to HYATT for help. Remember...

HYATT has more experience with gas turbine applications of roller bearings than anyone else in the field—why not profit by it?

# HYATT

ROLLER BEARINGS

STRAIGHT • TAPER • HYATT BEARINGS CORPORATION • KANSAS CITY, MISSOURI 64116

into the dragstrip to open as close the engine. Gearshift is approximately 1,800 times a minute, making possible the 1.5-second dragstrip stage survival.

The cover also incorporates an advance in rotary shafts. Rotary shafts at such an old hat to many engineers, but most designs have used a variable angular opening to control expansion. This has called for a complicated differential mechanism to control the variable angular opening, and angular differential in the opening itself have caused excessive vibrations. Furthermore it is difficult to make the shafts survive a precise fit with.

Efficiency of the shaft varies with the width of the air. The narrower the opening the less efficient the shaft. The reason is that the pressure effect becomes more pronounced, producing long the closed area can on the film in the edge of the shaft.

### Fixed Opening

The Fairchild design, by use of a fixed angular opening, maintains a constant shaft efficiency over the entire expansion range. The least element of shaft blade rotates at a constant 54 rpm regardless of the pull-down speed. This gives the shaft its 1/210th of a second speed, which is a little fast, but, and, finally, to cut down bearing from high speed speeds.

In a standard shaft drive is a straight-line one to one relationship between first-per-second film pull-down

### RB-58 System Simplified

A major improvement in the RB-58 steel reinforcement system, now a pilot production of Fairchild, is the incorporation in control of all component parts. By this elimination of Mach beam on rails, the system is much simpler and has fewer connections, reducing trouble potential.

Boeing's weight reduction (AW April 10, p. 25), Fairchild engineers have cut the total system now from 114 cu. ft. to 65 cu. ft. For the 745 is, control the system has been reduced from 700 lb. to 400 lb.

System includes three 50 lb. and three 10 lb. in control, one 30 lb. for the wing being major section compression control, and two aluminum reinforcement—each single 70 mm. downward during control at a rate of five downward from 70 mm. control.

The titanium sheet (up available), given included in its strength array of 40 deg. right and left deviation control from straight ahead to 90 deg. down, full of view of 10 and 40 deg. and a light range of 0.5 to 1.000 lb. inches.

MALLORY-SHARON reports on

## TITANIUM



How a **METAL IMPROVEMENT** helps  
maintain B-52 production schedules

• Here's the Boeing B-52 global bomber... flying 600 pounds lighter because the new metal titanium is used extensively in the jet-engine pods. But in forming titanium parts, Bell Aircraft, one of the firms which produces the complex pod assemblies, originally encountered production delays because of variable "springback" in forming titanium sheets of different strengths.

To overcome this, Bell segregates titanium into different strength groups, which are color-coded and handled separately with improved forming techniques. Here Mallory-Sharon's new "quality certification" of titanium proves a

substantial time saver. With this method, we not only meet specifications, but certify average strength of each heat we produce, and certify that 97.6% of each heat is in a narrow range of this average. This eliminates the need for tests to suggest quality among material... helps cut fabrication costs... and permits meeting production schedules on time.

Quality certification is another first from Mallory-Sharon... a leading producer of titanium and titanium alloy mill products. Call us for your requirements in this lightweight, strong, corrosion resistant metal.

MALLORY-SHARON TITANIUM CORPORATION NILES OHIO

MALLORY  SHARON



he's working  
for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country—and world—presenting the plans, laboratories and management concepts... reporting back to you every significant innovation in technology, selling tactics, management strategy. His functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine—the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and engineers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "hire" regularly and carefully to the practical business information he gathers.



McGraw-Hill PUBLICATIONS

speed and shutter rotation. The slower the film speed the slower the shutter revolves, and the angular opening becomes narrower—and thus less efficient—when it compensates for the needed shutter speed.

The rear element of the Fashold shutter, the coupling blade, has a rotational speed that varies with the frame rate.

At the fastest speed, 64 frames per second the film is exposed once for every revolution. At 32 frames per second the second shutter eye of blades cut each alternate exposure, and at 16 fps the second component cuts three out of four exposures. Angular opening between the blades remains constant; the exposure variation accomplished by coupling.

This demonstrates the complicated differential mechanism and hard-to-obtain angular tolerances of shutter blades.

#### Sprocket Film Drive

Fashold engineers developed a continuous capstan, intermittent output sprocket film drive. Standard "draw" is advanced the film were discarded.

With the new drive, several film sprocket holes are always engaged with the sprocket wheel ensuring constant engagement and positive drive film advance.

The continuous capstan is converted to intermittent output through an unusual adaptation of a Geneva type of drive.

Film capacity of the KB-5 is 50 ft. Fashold officials feel that the KB-5 with its built-in exposure control and other advanced features will attract the interests of building and maintaining exposure control attachments for existing N-9 gas cameras.



#### Aluminum Forging Press

High 1,000-ton hydraulic press produces high strength aluminum forgings up to 500 sq in. in area at Alcoa's Vernon, Cal. plant. Four steel rods at the corners make the press earthquake-proof.



Over a million engine hours of turbo-prop Viscount experience will be built into the Viscount 810-840

## the new 400 mph turbo-prop VISCOUNT 810-840

**higher cruising speed...**  
up to 400 miles an hour.

**bigger capacity...**  
up to 70 passengers.

**greater economy...**  
with the new Rolls-Royce Dart E-Da. 7 or E-Da. 8 turbo-prop engines.

**world wide experience...**  
gained from over a million hours of Viscount operations.

**passenger preference...**  
as proved by the installation of records of the Viscount 700.

These advantages make the Viscount 810-840 the ideal aircraft for medium load, high density routes. It will compare even the Viscount 700 series as a money maker for gross revenue airlines all over the world. The new Viscount 810-840 will make its debut in service for Continental Airlines in 1958.

Behind the new Viscount 810-840 stands the great name of the Vickers Group—internationally famous in matters of aircraft, ships, industrial machinery and process equipment.

V. S. Representatives: Christopher Charles,  
20 Rockefeller Plaza, New York 20, N. Y.

turbo-prop **VICKERS**  
**VISCOUNT**  
POWERED BY FOUR ROLLS-ROYCE DART ENGINES



## NEW AVIATION PRODUCTS



### Propeller Control Simulator

A simulator for production or prototype testing of propeller control systems, even flight conditions, such as air loading effects of the plane and engine response indicators. Nonlinear schedules and rates of response to various elements are also included.

Norvic Co., Manchester, Conn.



### Twin Pushers Remove Wrecks

Vehicles designed to clear runways of crashed aircraft weighing up to 400,000 lb. in less than 20 min. have been developed for the Air Force. Air Research & Development Command unit that formerly heavy, never took less than 15 min. to do this job. Photo shows two of the new vehicles moving a wrecked C-130.

The 55,000-lb. vehicle each weigh 150,000 lb. and have a 10-ft diameter wheel. They operate in pairs and are capable of moving the wreck.

R. G. LeTourneau, Inc., Longview, Tex.

### Cable and Fittings Tester

Machine for proof-testing aircraft cable and fitting assemblies is capable of testing cables up to 7,000 lb. pull. It has automatic cycling with tension holding for 10 seconds. The machine rejects defective assemblies for cable tests.

Hovett & Faust Manufacturing Co., 1171 Industrial Pkwy., El Cerrito, Calif.

### Highspeed Analysis Camera

A highspeed motion picture camera that can take good quality 16-mm photos in long field of view. Airborne model takes a maximum of 2,000 photos per second. A movie "film" is 1000 pictures per second.

A non-cement glass in the frontside



photo return has a high index of reflection and low dispersion, providing color transparency free from fringing. Units are designed to operate at 55 G shots, without causing optical distortion or warpage.

Beachfield Camera & Instrument Corp., Robbins Lane, Spacet, N. Y.

### Staff Valves for 2,000 Psi.

Two-way, air-actuated, double-throw for 2,000 psi service line.



straight-through, post construction, permitting compact straight-line run of hydraulic tubing. Standard sizes are available for one-quarter, three-eighths and one-half inch bore, or more.

A balanced service poppet provides a wide range of flow and pressure in other direction. Units meet MIL-V-5723A specifications.

Aircraft Products Co., 300 Church Rd., Bridgeport, Pa.

### Drug Fights Fatigue

U. S. Air Force is testing a new anti-fatigue drug called Mestron that is reported to enhance safety and a measure of resistance effects with the ability to restore personnel concentration and efficiency. Mestron, it is reported, appears to avoid effects on



### Light Pneumatic Spheres

Thin 50-cu. in. capacity thin glass spheres, used for strength parameter applications, weigh 16 lb. compared with 25 lb. for comparable steel-based and composites. Thin weight saving can be significant in high-speed tests. Manufactured by Wilco-Kalfe & Co., Inc., units come in various sizes 10-1,000 cu. in. with operating pressures to 1,000 psi.

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**Engineered by Vought  
...World's**

**Fastest  
Navy  
Fighter**

**Faster-than-sound Crusader Will Strengthen  
U. S. Fleet's Command of the Seas About the Seas**

Chosen Vought's F-4 Phantom II represents the next generation of Navy fighters. It combines tremendous load-fight performance with improved combat ceiling, long endurance and state-of-the-art maneuverability and armament. Like many other significant Vought advances, it emphasizes a tradition of engineering excellence.

Behind this triumph in aviation achievement lie an extensive research and development program, and experience gained in 30 years of pioneering leadership. Like many other significant Vought advances, it emphasizes a tradition of engineering excellence.

In the field of high performance aircraft, as well as guided missiles, the engine space is shared at Vought. Because of this spirit, America can continue to depend upon new weapons from Vought—no longer as the need for them exists.

SCIENTISTS AND ENGINEERS: There is a challenge ahead for you in Vought's creative work force. For details, write: Engineering Personnel, P. O. Box 500, Dallas, Texas.

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## NEW... WESTINGHOUSE AIR HANDLING COMBINATION UNITS in 13 basic sizes give you Unlimited Selection...

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These versatile units, each with a choice of two real face sizes, in five coil types (see panel on right) and accessories as required, permit you to select from the broadest line in the industry.

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**DIRECT EXPANSION P-H COILS**  
AND REHEATING — 2, 4, 6 and 8 rows deep



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**STANDARD STEAM HEATING COILS** for use with radiating dampers over 1-1/2 and 2 rows deep with 3 fins in depth



**STEAM HEATING COILS** for use with radiating dampers over 1-1/2 and 2 rows deep with 3 fins in depth



**HIGH FEED STEAM HEATING COILS** available in 10, 12, 14 and 16 row deep with 2 fins in depth. Operated in two coils in single cooling—supply and condensation connections of each independent circulation.

blood pressure and sleep in motion experienced with other types of this type.

Tests were conducted by USAF School of Medicine, Randolph AFB, Tex. William S. Merrill Co., Cincinnati, Ohio.



### Aircraft Graph Recorder

An instrument for recording in aircraft's history of acceleration, altitude, airspeed, fuel pressure and structural strains for the time preceding the accident, retains information only if the pilot crashes. Of the standard record-making magnetic type, it does not use electronics to buffer the recorder or its playback.

Record is a metal plate, recording is not required.

Continental Manufacturing & Development Corp., P.O. Box 573, Los Altos, Calif.

### Plastic Coated Fabric

A DuPont fabric coated with Hypalon plastic, developed by Air Research & Development, Cincinnati for air-supported radar structures, will provide weight savings of about 50% over existing fabrics.

Called Durelon, the material is reported to have excellent electrical properties, good resistance to sunlight and ozone aging. Material weighs about 7.5 oz./sq. yd.; extends just a cutting of about three to 5.5 oz./sq. yd. and the interior about 1 to 1.5 oz./sq. yd. Breaking strength is extended at 450 lb./sq. in.

Air Research & Development Company, C. S. Ash Finner, P.O. Box 1195, Baltimore 5, Md.

## WHAT'S NEW

### Telling the Market

Application methods, etc. on Joseph J-40 surface and for asphalt pavements, catalog LE-2903. Maintenance: Joe, Worcester Co. How to pack his maximum instrument: portable, brilliant, Arner, Chief, Elder, Dorian, North Boston Rd., Alliance, Ga. . . . Calico

added Performance

# teflon<sup>®</sup> CABLE

More, improved Teflon coated cables are now available from AMPHENOL than from any other source.

Military Specification	Part Number	Size	Max. Temp. (°C)
Q12	40-100	14	175
Q13	40-100	16	175
Q14	40-100	18	175
Q15	40-100	20	175
Q16	40-100	22	175
Q17	40-100	24	175
Q18	40-100	26	175
Q19	40-100	28	175
Q20	40-100	30	175
Q21	40-100	32	175
Q22	40-100	34	175
Q23	40-100	36	175
Q24	40-100	38	175
Q25	40-100	40	175
Q26	40-100	42	175
Q27	40-100	44	175
Q28	40-100	46	175
Q29	40-100	48	175
Q30	40-100	50	175

Teflon cables operate without difficulty at temperatures from -55°C to +250°C. The high power-handling capabilities and the weight and space saving possible with Teflon cables make them ideal for aircraft equipment.

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added Reliability

## CAPTIVATED CONTACT<sup>®</sup> RF CONNECTORS

Only AMPHENOL provides connectors to go with the Teflon cables it makes—not only a single-source advantage but also a guarantee of engineering responsibility. Latest addition to the RF connector line are Captivated Contact connectors in Series M and LCN. These connectors with SMA, 3/8 and 1/8 Teflon cables provide added reliability.

\*Patent pending



AMPHENOL

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Whisper 56, Albany



## TORRINGTON

### DC needle bearings give high-capacity performance in minimum space



**Unique construction**—a country design, end-face-hardened shell retains rollers and serves as outer bearing.



**Full complement of small diameter rollers**—green-man-ground and through-hardened—available top capacity by distributing load over large number of rollers.



**Tapered tips of the case-hardened outer shell** keep dirt and grit out, lubricate low-white retreating-injection ends of rollers. All wear surfaces of outer race are case-hardened.



**No inner race required** on surface-hardened shafts—reduces space requirements, lowers cost.

**Simple assembly**—major parts match bearing in round bearing bore. No collars, shoulders or retaining rings needed.



**Closed and type DC Needle Bearings** are available for stub shaft applications. The closed and provides a perfect seal in no space out.



Needle bearings are made in a Precision Series for most applications and an Extra Precision Series where low initial play and maximum repeatability are required. Easy lubrication through optional hole in shell or through hole in shell allows long service life. Bearings can be pre-packed with suitable grease for those applications requiring grease lubrication.

See our new Needle Bearing Order in the 1966 Saefts Product Guide P-6—on order form for Catalog No. 24.

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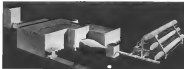
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handles for industrial, military and commercial applications. Catalog No. Part Carbon Co., Inc., St. Mary, Pa. . . . Selection tables, performance charts, etc., on carbon-alkaldehyde compounds and composite materials. Bulletin A 1750-D, Vacuum, Inc., 1400 Oakmont Blvd., Detroit 12, Mich.

Presentation of small pressure-resistant ball bearings, industrial standard. New Hemisphere Ball Bearings, Inc., Fairbrough, N. H. . . . Parts breakdown of fuel through and standard terminals and custom molded nylon and plastic components. White, Inc., Dept. AWN, 9148 Revere St., Schiller Park, Ill. . . . Brochure CP-5126 on uses, specifications and prices at distributors for precision and pressure sensitive tape, and Schenker #11 on two-way scanning tape method of custom tailoring versus assembly. Better Packaging, Inc., Shelton, Conn. . . . Sets have explanation and new variations of basic acids for fuel delivery equipment, series. Clifford B. Thomas & Son, Inc., 24 Maple St., Westfield, N. Y.

Extensives by Harper, booklet, H. M. Harper Co., Metall Division, 5220 Lehigh Ave., Norristown, Pa. . . . Chart of physical properties of tooling steels, including cutting and lubricating materials and lubricants on Enduro steel steels. Harco Plastics, Inc., 4194 Blvd. St., Los Angeles 90, Calif. . . . Guide to automatic-type instruments, booklet, Merritt Instrument Co., 11054 Madison Ave., Cleveland 2, O.

Application techniques and precautions, advantages and limits of adhesive bonding at room temperatures, booklet Rubber & Adhesive Corp., Dept. P., Brookfield, N. J. . . . Capabilities polyvinyl chloride pipe, booklet, Miller Tube Division, Carpenter Steel Co., Union, N. J.



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## New Publications

The Aircraft of the World—by William Green and Gerald Pollinger-Pub. by Havers House, 175 Madison Ave., New York 17, N. Y. \$7.95. 131 pp. About 1,200 ill.

Specifications, photo, three-view and details of nearly 1,200 aircraft, including military wing. Contains not only new aircraft, but many old-time still active.

The Airplane at Work for Business and Industry—Prepared by the Office of Planning, Research and Development and available through the Civil Aeronautics Administration, U.S. Department of Commerce, Washington 25, D. C. \$1.60. 75 pp.

This review presents the results of a 1955 survey covering all civil flying in 1954 except that performed by the scheduled airlines and by the CAA itself.

Preliminary estimates for 1955 are included in the survey.

Aerial Directory of Canada—Pub. by Aircraft Magazine, 341 Church Street, Toronto 2 Ont., Canada. U.S. price \$1.00.

Section on the aircraft industry, the air transport industry, military aviation, government departments and organizations, various organizations and publications, sources of supply and services.

A Simple Guide to Blueprint Reading with Applications to Aircraft—by W. L. Wright, Jr., Wright-Patt. by McGraw-Hill Book Co., 1221 West 57 Street, New York 36, N. Y. 14, revised edition of A Simple Guide to Blueprint Reading, Copyright 1941 1945, in William Wright's Photographs and many diagrams.

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(Continued from page 23)

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Richard W. (Dick) Taylor, flight test chief, Wrights, according to Edward Marshall assigned to Seattle Transport Division military sales Boeing Aerospace Co., Seattle, Wash.

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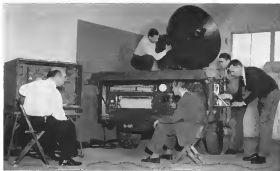


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## SAFETY

### British Accidents Investigation Branch Report:

## Wrong Prop Feathered, Viscount Fell

A Vickers-Armstrongs Viscount Type 701 crashed and operated by the British European Airways Corp., crashed during takeoff on a training flight at Blackbushe Airport, Eng. last Jan. 25, 1916, slightly injuring all five persons on board.

Capt. D. A. Langhorne was in command of the training flight. Others in the plane were Capt. D. J. Turner, Radio Officer; A. V. V. Capt. P. C. Seely, and First Officer R. A. Treadwell.

The accident took place at 8:50 hours, Greenwich Mean Time, 100 ft above the ground in C-1711.

The accident occurred during takeoff on a training flight which was part of a routine Run Check being carried out by Captain Langhorne, a Training Captain on Captain Turner, a Line Captain. Upon reaching the runway, the aircraft was feathered, and the engine was shut down.

At this point the aircraft was still on the ground and as it did so the aircraft was feathered, and the engine was shut down.

The aircraft was then moved to the runway and as it did so the aircraft was feathered, and the engine was shut down.

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After joining with the RAF during the war he joined B.E.A. in July, 1946 and was made a Captain the following December. He was selected as a Training Captain in November 1951 and since he had been previously employed on training duties he was promoted to Senior Captain in December 1951 and then selected for the Viscount Flight in 1952 he was named as a Viscount Pilot Captain and later Training Captain.

Later in 1954 he was promoted to Training Captain but he was unable to meet his duties as a Training Captain in 1955 and was promoted to Senior Captain in 1956.

At the time of the accident he had completed a total of over 1,000 hours flying, of which about 1,000 hours had been as Captain in Viscount. He had flown 1,100 hours on training work in Viscount with a further 100 hours as a Senior Captain.

• Captain Turner, who had been a pilot in the RAF, had been a pilot in the RAF for 10 years and was a pilot in the RAF for 10 years.

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ended to Cardiff where it arrived at about 10:15 hrs.

The intention of making an ILS approach then was thwarted because the frequency had recently been changed and the aircraft was not on the new frequency. Captain Langhorne decided to proceed to Blackbushe. He was given a VFR clearance and then returned to No. 1 engine. The aircraft was then cleared to proceed to Blackbushe.

No. 1 propeller position to a three engine approach and on arrival using the ILS on January 26.

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was made by No. 3 poppet and the restricted flow followed by the shrouded meter side of the vent and the shrouded meter tip. The only half of the chamber of expansion inside all shown at more, closely followed by No. 4 poppet.

The search continued still along back ends on its body and came to eye more 200 vials from the point of metal impact No. 4 cap and with its massive shroud broke off in its way, leaving only and one long clear of the area nearby. The last distance most of the search for the joint section was intact and contained by her.

Three of the blades of No. 3 poppet were in the feathering stage, while those of the No. 4 poppet were in the last patch stage. Damage to the blades indicated that No. 3 poppet was about stationary on impact and that No. 4 was rotating.

Examination of the control room indicated that No. 3 I.P. rack lever was selected in the feathering position so as to allow which the latch must be moved and the rear wheel right back through the pit.

The other three I.P. rack levers were forward of the gate. The third was all ready fully open but these positions were considered to be inevitable owing to the effects of crash damage.

## Subsequent Examination

Not long after three poppet and poppet were returned to London Airport for further examination. It was anticipated that No. 3 poppet retaining piston was in the position to be expected if the I.P. rack lever had been moved in the feathering position and the feathering piston had not been opened.

It was also indicated that the No. 4 poppet piston was in position that the blades would have been in the patch and giving approximately 10,000 rpm at the moment of impact. Clamped and mechanical feathering had indicated by reason were moved out on No. 4 poppet to enable the blades to be in the patch and it was found that the system functioned normally.

## OBSERVATIONS

A examination of the evidence is in common with the S.E.A. shall for general feathering effect it appears that Captain Langford had moved No. 3 I.P. rack lever (which was two inches longer than No. 4) in the feathering position instead of No. 4, and had then feathered back No. 4 cap and moved No. 4 feathering piston. These actions cut off the last from No. 3 engine and feathered its poppet and also reduced No. 4 rpm to 10,000 rpm. The No. 4 feathering piston had no effect on No. 4 poppet; however in the I.P. rack lever was not in the feathering position. The search was then stopped at all points in the shrouded side at the moment of the coming shrouded and the shrouded side would have been by No. 4 poppet falling in the patch. Captain Langford believed he had completed feathering of No. 4 rpm and to confirm the planned reply at the ground showing 10,000 rpm and temperature pressure for No. 4 rpm, both of which he read in rpm. Because the engine was feathered right back the propeller piston could have been not but the small position of the two pistons rpm. The search would have been

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selecting 10,000 in his rapid glance at the page he must have scanned it.

• Movement of the throttle in the landing gear lift in this instance was not necessary, as even mechanical inspection was not being used. The movement was isolated in the landing gear lift only to an oil valve mechanical inspection which that system was being used. Following this inspection, B.L.A. noted information that indicated engine failure on take-off during landing flights would only be made when the use of a mechanical inspection was necessary. The staff was shared accordingly to check movement of the throttle.

### CONCLUSIONS

- The documentation of the results was a matter.
- The crew was properly trained.
- There was no violation of any previous rules.
- The Training Captain reported No. 3 H.P. took over control of No. 4.
- All power from both mechanical engines was lost at a critical point of the take-off.

### OPINION

The accident was due to an error by the Training Captain who reported No. 3 high power, took over control of No. 4 when reporting a failure of No. 4 engine during take-off. This resulted in the loss of all power from both mechanical engines at a critical point of the take-off.

### COMPLIANCE WITH REGULATIONS

In conducting the investigation the provisions of paragraph (5) of Regulation 7 of the Civil Aviation (Investigation of Accidents) Regulations, 1911 (amended) Statute (Canada) No. 1613 of 1913 have been complied with.

F. G. Twiss  
Chief Inspector of Accidents



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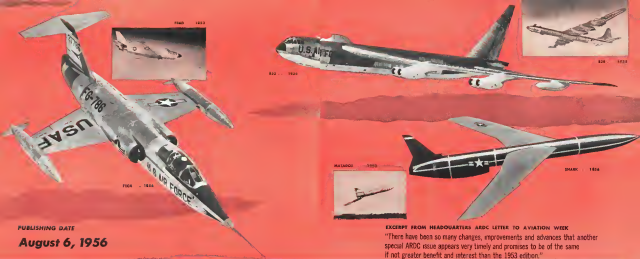
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A MESSAGE  
TO AMERICAN  
INDUSTRY  
• FIRST OF A  
SPECIAL SERIES

## THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

### How Critical Is It?

The United States is running into a serious shortage of scientists and engineers. There is no novelty in this observation. It has often been made in the last ten years. And there has been mounting alarm about what this shortage may mean for both our national security and our prosperity.

There would be great irony, however, if general agreement were assumed on such important matters in the face of the shortage, the extent of the damage it threatens to inflict, and the best ways to eliminate it. The purpose of these editorials is not to provide this novelty, but to ventilate some of the key aspects of the shortage of scientists and engineers.

This first editorial in the series is designed to throw light on the overall dimensions of the shortage. Others will be addressed to such questions as:

- How serious is the threat to our economic well-being and to our national security?
- What needs to be done to prevent the shortage from becoming critical?

The problem is not that we have been producing a small number of engineers and scientists. Indeed, the number has risen sharply. We now have a working force of more than 900,000 engineers, over twice as many as the 385,000 there were in 1949. And we have about 250,000 scientists (chemists, physicists, biologists, geologists, mathematicians, etc.), compared to only 85,000 in 1949. About one in 144 persons in the labor force of 1949 was a scientist or engineer; today the ratio is about one in every 80.

In research and development work, where highly creative scientific minds are required, there has been lullaby as rapid a rise in employment of scientists and engineers. Fewer than 80,000 were employed in research and development fifteen years ago; the total now exceeds 200,000.

Despite this rapid increase in the number of scientists and engineers — at a rate much faster than the increase in the labor force as a whole — the needs of industry, government and education for technically trained people have risen even more sharply.

The principal reason for this mounting demand is the prodigious growth of research in the last 15 years. From a total of only about \$700 million spent on all types of research in 1941, the annual expenditure rose to over \$5 billion by 1955 (the latest estimate available). Over two-thirds of the research is done by private industry, mostly to develop new and better products and to find new and better methods of production. Most of the rest is performed by the government, largely to develop improved and inevitably more complex scientific weapons.

One aircraft company has found from its own experience that it required 17,000 engineering manhours to develop a typical fighter plane in 1946. The requirement is now about 14 million engineering manhours. Development of the typical fighter plane of 1960 will require well over 2 million engineering manhours.

In this dramatic example, the need for engineering services for a basic piece of military equipment soared 80 times in 15 years. It is an indication

of why the demand for more and more technically trained men and women has outstripped even the imposing increase in scientific and engineering manpower of the last decade and a half.

## Size of the Shortage

Exactly how great the gap is between the available supply of scientists and engineers and the number required, it is impossible to say. In some instances technical talent undoubtedly could be better used than it is now. And part of the shortage might "disappear" if higher salaries had to be paid. (These questions will be discussed in later editorials.) But informed estimates of the approximate size of the gap can be given.

● According to the best available information, from estimates by the Engineers' Joint Council and the U. S. Bureau of Labor Statistics, the minimum need for engineers from graduating classes is 40,000 each year for the next ten years. Last year we graduated only 23,000 engineers, just about enough to cover replacement needs without allowing for any expansion of the number of active engineers. Projections made by the U. S. Office of Education indicate that we shall probably not have a class of 40,000—the current annual requirement—until 1963.

● According to Dr. Howard Meischoff, executive director of the Scientific Manpower Commission, there is now a shortage of about 20,000 scientists. Last year the number of doctoral degrees in the natural sciences, almost a prerequisite for research work, was only 5,000. Dr. Meischoff estimates that the shortage of scientists will rise another 30,000 by 1960.

## More Needed as Teachers

Not all of the graduates with scientific and engineering training, furthermore, will work as scientists and engineers—that is, by performing research and giving it practical application. Such training is now necessary in many sales and management positions. And more of our technically trained men and women must remain in educational institutions as teachers of the quality of engineering and scientific education is to be maintained. A survey in 1954-55 by the National Education Association showed that, out of 227 universities, state colleges and large private colleges, nearly one third already had unfilled vacancies in engineering and the sciences had vacancies in physical sciences.

The dimensions of the shortage of scientists and engineers can be seen more fully as follows. Despite a substantial rise in the unfilled manpower available, the needs of industry, the government and education have risen still faster. The best information indicates that, on the basis of current and anticipated needs, our recent reach rates of production of slightly over 30,000 engineers and about 5,000 Ph.D.'s in natural sciences could be doubled without closing the gap entirely.

The disturbing implications of this shortage for our national security and our prosperity and some practical suggestions for eliminating it will be the subjects of subsequent editorials in this series.

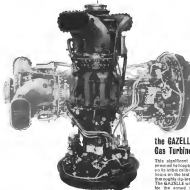
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Dr. Theodore Thodorsen, Ph.D., Physics, Johns Hopkins U., formerly consultant for Research, U.S. Research and Development Command, Vice President and Dean of Engineering, Tufts Inst. of Aeronautics, Rice de Janssen, Comstock, Brooks Div. of United Aircraft, Chief of Physical Research at RACA in Langley Field 1929-1946, discoverer of concept theory of passive data bases on airplane wings, theory of wing flutter, theory of dual propelling, structure of turbulence; author of numerous technical papers, Fellow and founding member, AAS.

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**FOR SALE 28-5 ACF**

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## LETTERS

## B-52 Vs. Snark

The post second round of *Arctura* Wars have given me the impression that the USM is somewhat unimpressed about our internationalist response. The polemic seems to be whether or not the U.S. should match the Russian's *Evros* position with *EVU* or do what some fairly big State Dept. members

(1) The mechanism of the Bank and

- (1) The performance of the 5000 and the 8500 is about the same.
- (2) Both the 8500 and the 5500 are data-driven models.
- (3) The 8500 is more accurate. In a period of seven, modified, the 8500 can detect concentrated bursts in the event log more quickly and accurately than the 5000. It is possible to control the 8500's rate using a threshold to adjust false, suppress irrelevant bursts. These methods, the 5000 can not do with the 8500.

The argument is weak, furthermore, that a Strick costs only 5% of a long-range bomber, is a poor selling point. SAC has observed that bomber losses today would be no greater than they were in World War II, i.e. about 1 in 30. This fact eliminates any financial savings for South Korea, they are not too much.

The Bank is pleased to provide a report as soon as it can be prepared to advise that the UKM has the full subconveyance needed but this is under review and scrutiny in the BCL.

Leifon F. Ingram  
5124 Elm Avenue  
Menlo Park, California

## ICBM Tactics

[illegible]

Such a situation is possible on the ICBN when it is impossible on earth because the material can be shredded while in the atmosphere after launching and the thread can be shredded on contact again.

Nancy W. Williams

(All known materials capable of absorbing at least partially incident energy, are either soft rubbery materials or plastics, neither of

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[illegible]

## Engineer Shortage

At the 100th anniversary of the profession's birth, the Utilization of Engineers in 1900, March 25th issue. Despite the various examples in both case studies cited, the nature of the problem has hardly been resolved. Apparently, the books required by the second students in its early days when they could get all the responses they wanted still point. The lack of young graduate engineers to perform all tasks in a day, making department is only slowly being broken.

### Session Criteria

In seeking the truth, however, better attention to the overall industry is needed to be convinced that this is cheap. I would like to suggest three criteria to distinguish between those companies who are sufficiently concerned about application to make do something about it and those other companies who are only sufficiently concerned to talk about it.

- 1 Does the company subscribe to a policy of employee development and engineering education? If so, does this encourage? Does it subsidize, for persons who complete a course of study, a stipend and then dropped out of college?
- 2 Does the company provide really attractive profit sharing to encourage the good professional employee? A bonus plan must be adequate to attract a professional employee, but it must mean to him loss of work. Otherwise there will seem to be a cap on each people's desire to work to relieve congestion of their own company.
- 3 Does the company provide facilities which are consistent to creative growth? No company which provides a laboratory for thinking, research, and development, and a good environment, is not a good company. The environment is an important factor in the success of a company.

1997 direct pollution to water in the  
northeast (Fig. 1).

The most serious aspect of post-9/11 terrorism is one which is often overlooked. As someone who has devoted the majority of his first five years on to performing trials which he could have performed after graduation from high school, it is very much less capable than he could have been with five years of professional experience. Not only so, he failed to grasp at the size of which he was capable but he has also negated much of his college education.

Yule from the limited problem of poor influence. There is no real easy solution for the employed professional engineers by the day. By increasing speed rates and special payoffs for their supervisors most companies have made supervisors the girl of most engineers. The practice has had the following results:

- 1 The engineer who prefers to perform engineering his life while career is varied by ones in being an offshore engineer who could not make the grade into supervisor.
- 2 Those engineers who do transfer into

## Supervisor Pay

In addition to the disadvantages related above, in the comparison, the tendency is that in relation to responsibility, supervisors are usually the second most common

So long as less than 9% of the proteins are monomeric—less than 10%, even when

engineering experiment we included—note that five times the volume of the one-year computer experiment, how can we argue that a professional course with more than 100 students can persuade high ability students to pursue a professional career when employment is not good? There is no shortage of skill, but not effective action to alleviate the fundamental problems is at one to two's best.

Don N. Simonson, Jr.  
President  
Seattle Professional Engineering Employees  
Assn.  
1120 Avenue Building

### 'Good Information'

You two articles on the engineering short age govt. conflict courage to an important and current problem. They contain good information on the opinions of people involved in our war on the solution to the problem and I find many helpful suggestions which I shall certainly examine in possible adoption.

R. L. Berman  
Assistant Chief Engineer, Administration  
Baptist Avenue Corp.  
Fairfield, L. I., New York

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